FLIGHT
and The AIRCRAFT ENGINEER

FIRST AERONAUTICAL WEEKLY IN THE WORLD : FOUNDED 1909

Editor C. M. POULSEN

Managing Editor G. GEOFFREY SMITH

Chief Photographer JOHN YOXALL

Editorial, Advertising and Publishing Offices: DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1

Telegrams: Truditur, Sedist, London. Telephone: Waterloo 3333 (50 lines).

8-10, CORPORATION ST., COVENTRY. Telegrams: Autocar, Coventry. Telephone: Coventry 5210.

GUILDHALL BUILDINGS, NAVIGATION ST., BIRMINGHAM, 2. Telegrams: Autopress, Birmingham. Telephone: Midland 2971 (5 lines).

260, DEANSGATE, MANCHESTER, 3. Telegrams: Iliffe, Manchester. Telephone: Blackfriars 4412.

26B, RENFIELD ST., GLASGOW, C.2. Telegrams: Iliffe, Glasgow. Telephone: Central 4857.

SUBSCRIPTION RATES: Home and Canada: Year, £1 13 0. 6 months, 16s. 6d. 3 months, 8s. 6d.
Other Countries: Year, £1 16 0. 6 months, 18s. 0d. 3 months, 9s. 0d.

No. 1612. Vol. XXXVI. NOVEMBER 16, 1939 Thursdays, Price 6d.

The Outlook

Interchangeability

AMONG those firms which have come into the aircraft industry fairly recently there was at first a tendency to regard as unnecessary many of the close limits to which they were asked to work. When such accuracy was demanded in a portion of an aircraft structure of stressed-skin construction, it might well seem that the tolerances were rather ridiculous. What was frequently overlooked was the fact that a tail unit made by the A factory might have to be fitted to a fuselage rear portion made by C or D or many other works. To make that possible, the strictest adherence to dimensions was essential.

In this issue we publish an article by a practical man in which a plea is made for interchangeability of another sort. It refers to the possibility of standardising complete "power eggs" so that the aircraft designer's task ceases at the fireproof bulkhead or thereabout. The idea is not, of course, new. The suggestion has cropped up every now and again at Royal Aeronautical Society lectures and elsewhere. But although certain engine firms have done much work on standardised engine units, complete with mounting and cowling, little progress has been made towards its general adoption.

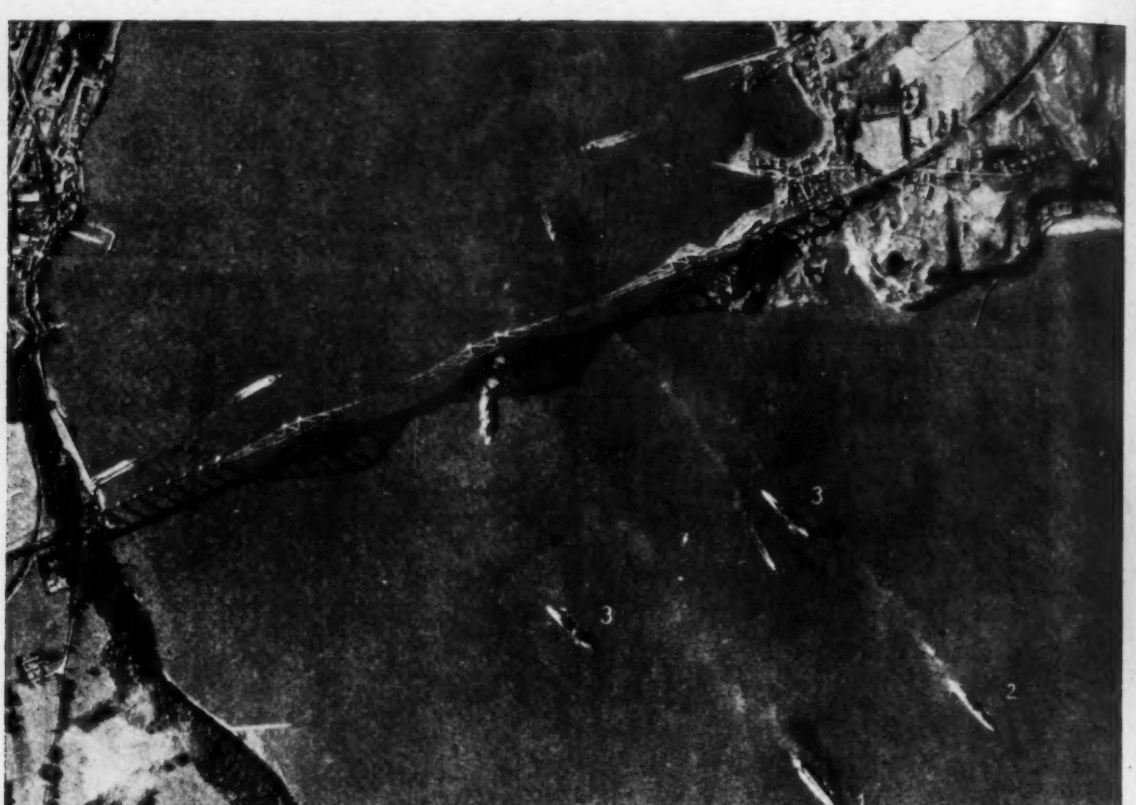
That there are a good many difficulties emerges from a perusal of the article. But they do not seem to be insurmountable. The engine manufacturers are all, we believe, in favour of the idea, but certain aircraft designers have their own views of how an engine should be mounted and, particularly, cowled. The author of the article deals with some of the problems encountered, but not by any means with all. It would be interesting to hear what our aircraft designers have to say. We know that some of them consider the objections too great. But these same designers said the same about retractable undercarriages.

Fighting Coastals

WHEN enemy aircraft attack a convoy of ships near the coasts of Britain and fighters go out to the rescue, there is nothing surprising in hearing that some of the attackers have been shot down. That was to be expected. What is particularly gratifying is the number of reports which come in week after week of combats between general reconnaissance machines of the Coastal Command and enemy seaplanes (sometimes floatplanes, sometimes flying boats) over the North Sea. It seems that the Dorniers and others are very active in trying to keep the enemy headquarters posted with information about the movements of British shipping and British fleets. Our G.R. machines are not less busy in scouring the sea round our coasts in search of enemy U-boats or other undesirables. Encounters between these G.R. aircraft and enemy seaplanes are not uncommon, and our men never hesitate to attack. Fighting is not the primary business of aircraft which have been designed for scouting over the sea, yet time and again the pilots and gunners in them have either shot down or seriously damaged the enemy craft. In this issue the story is recounted of how one of our G.R. machines fought with two enemy aircraft in turn, made seven diving attacks in succession, shot down one, and only left the second alone when all its own ammunition had been exhausted. Yet flying boats are not despicable opponents. They are well armed, and when they fly low over the water it is impossible for the assailant to find the blind spot under the hull.

Bombing attacks on U-boats had been envisaged as one of the functions of these squadrons, though scouting and reporting had been regarded as their speciality. Air combat had been thought less likely, but it has not come amiss to the crews, and they deserve hearty congratulations on their repeated successes.

A MISS IS AS GOOD AS A MILE



AS THE GERMANS SAW IT: An aerial view of the Forth Bridge, photographed by a member of the crew of one of the German aeroplanes which attempted to bomb the bridge. A bomb can be seen exploding in the water, not far from the bridge. The warships are three light cruisers and the aircraft carrier *Furious*.

Escorts for Bombers

THE tension in Holland seems to have relaxed, but none the less it is interesting to speculate how the strategical position would be affected if Germany were to use aerodromes in Holland as air bases. It is assumed in many quarters that she would then be able to send fighters to escort her bombers in raids on Great Britain. Perhaps that would be possible, but it is by no means certain that the Messerschmitt 109 or the Heinkel 112 could undertake that task with confidence. The endurance of those two types with engines throttled down to the speed of bombers is not precisely known. The figure of 445 miles has been mentioned, but it is not clear to what degree of throttle that applies. The distance from Rotterdam aerodrome to the London area is some 180 to 190 miles in a straight line. It is not always possible for a raid to follow a straight line, especially when it starts without reports of the weather ahead. Then, if the German fighters had to engage our fighters they would have to open their throttles to the utmost, and the precious petrol would then begin to disappear at a terrific rate.

Oswald Boelcke, the greatest leader of German fighters in the last war, wrote that when his men crossed the lines they must always be thinking of the return journey and the petrol needed for it. Similar thoughts would surely occupy the minds of German fighter pilots over Britain who had to get back to Rotterdam, and such reflections would not be an inspiration for whole-hearted combat.

Of course, long-range fighters might be used, but they would be at a disadvantage against the Hurricanes and Spitfires. Another consideration is that the surfaces of aerodromes in Holland have to be specially prepared, and if our bombers were to plaster them with shell holes, the damage the bombs did could not be easily made good.

Bombs on British Soil

SO at last a few bombs, eight to be accurate, have fallen on British soil. Of all the extraordinary places the Shetland Islands have been selected for this honour. We hope that the famous ponies were not disturbed. Several windows were broken, and in Ultima Thule it may be difficult to get them reglazed in a short time. One empty cottage was damaged, and one road has been temporarily blocked, but the traffic there is not quite so heavy as on the Great West Road.

The Germans have been threatening the Shetlands for some time, and on more than one occasion have reconnoitred the little archipelago. They evidently meant to make quite sure of what they were doing before they did it. But why did they do it? Did they by any chance mistake the Shetlands for the Orkneys?

The ROYAL AUSTRALIAN AIR FORCE

On the factory tarmac at Melbourne, the first Australian-built "Wirraways."

Evolution of R.A.A.F. : Expeditionary Force and Empire Training Scheme Mark Latest Stages

(Last week's article, "Aviation in Australia," summed up the commercial side of the Dominion's flying. This week's article tells of the expansion of the military air arm)

By MICHAEL TERRY, F.R.G.S., F.R.E.S.

LATE in 1915 two disconsolate "guests of the unspeakable" jolted in a rough cart across the desert from Baghdad to Mosul. Capt. White, recently Minister of Customs in Australia, and Capt. Yeats-Brown, author of "Bengal Lancer," had been captured by the Turks when flying behind their lines during the ill-fated advance upon the City of the Magic Carpet. They were being moved to that terrible captivity which lasted till the end of the war and which prompted White to write his enthralling "Guests of the Unspeakable."

What a gallant manœuvre they had carried out. What dismal luck that a single, miserable mounted gendarme had been the reason for their crash. Ordered to land and cut the telegraph wires which connected the Turkish front with Baghdad, they touched down and were moving close to the poles when a mounted gendarme appeared unexpectedly, so that in swerving to miss him they collided with a telegraph pole and wrecked a wing. Yeats-Brown, the observer, leapt out and, disregarding fire from Arabs, ran to the line, which he destroyed with gun-cotton. Meanwhile, White, having filled the tanks again with petrol from spare tins, was keeping off attackers with a rifle. Blithely he and his observer hoped to escape, as they had some days earlier, by ground-running across the desert to their own lines. This time, however, the Arabs were too many for them. They were being roughly handled when Turks came up and took them over.

This misfortune, coupled with others, to the first Australian flying unit to join active service in the Great War reduced the Australian Half Flight of No. 30 Squadron R.F.C. to one machine and one pilot: Capt. Petre, with a M.F.7.

How they happened to be there with M.F.s, Caudrons and Martinsydes dates back to a cable from the Viceroy of India to the Australian Government on February 8, 1915: Quick to respond to the call for pilots, men and equipment, although unable to provide machines, Australia wired on the 28th that four flying officers, eighteen mechanics, a motor car, a motor bicycle and eleven lorries would be ready shortly. Besides these men there were horses and mules, with a farrier sergeant and drivers in anticipation of trouble with motor transport in the desert sands beside the Tigris. To-day, with fully mechanised armies, and particularly air forces, such a mixture of transport makes one smile.

When war broke out the Commonwealth Government had already shown its interest in aviation by establishing a flying school at Point Cook, on the shore of Port Phillip and about twenty miles by road from Melbourne. It is there, although, of course, greatly enlarged, to this day and remains still the principal training centre. In 1914 Point Cook possessed five 'planes, in the charge of Petre and Harrison,* who may be said to be the fathers of military aviation in Australia.

From this modest start the Australian Flying Corps developed. Number 1 Squadron left Melbourne on March 14, 1916, with 28 officers and 181 men; Number 2 was sent to England, for training at R.F.C. establishments, in October, 1916; Number 3, raised in Egypt from the Australian Division, was sent to England for training late that year; Number 4 left Australia in January, 1917, also

* Major Petre made the British Gliding Record in 1931; Group-Captain Harrison R.A.A.F.

The writer, between pilot Woods and Birks, before a trip in from Wallal station on 90-Mile Beach, south of Broome.

for training in the old country with the R.F.C. In common with the practice whereby Australian naval units become part of the Royal Navy when they are transferred for service with it beyond Australian waters, these squadrons were merged with the R.F.C. and became Nos. 67, 68, 69 and 71 respectively. Yet, so far as possible, their Australian identity was preserved, particularly in regard to personnel, for this Dominion was the only one to have its own Air Force during the last war.

No. 1 Squadron served in the Eastern Egyptian desert and in Palestine, the rest of them in France from the end of 1917 till the war ceased, between Soissons and the North Sea. Martinsydes and Bristol Fighters were used in Palestine; S.E.5s and Sopwith Camels in France. The four squadrons numbered 603 pilots, observers and ground officers. Although suffering considerable casualties (179), they destroyed and drove down 527 enemy machines with the loss of only 60 of their own by enemy action. Which is, indeed, no feeble testimony to the skill of Australian air fighters

England-Australia Competition

Many Australians remained air-minded after active service. During demobilisation the Commonwealth Government offered £10,000 for the first one of them to fly from England to Australia within thirty days. Six parties started, but only two arrived. Ross and Keith Smith got the prize. Parer and McIntosh, who failed to win, put up a flight which for sheer endurance and courage is still the most memorable of all during the development of our great Empire route. Others, like Kingsford-Smith, Cobby, Brierley, Hudson-Fysh, Keith Smith, Parer, fostered and developed to its present efficient state the network of airlines above Australia and New Guinea.

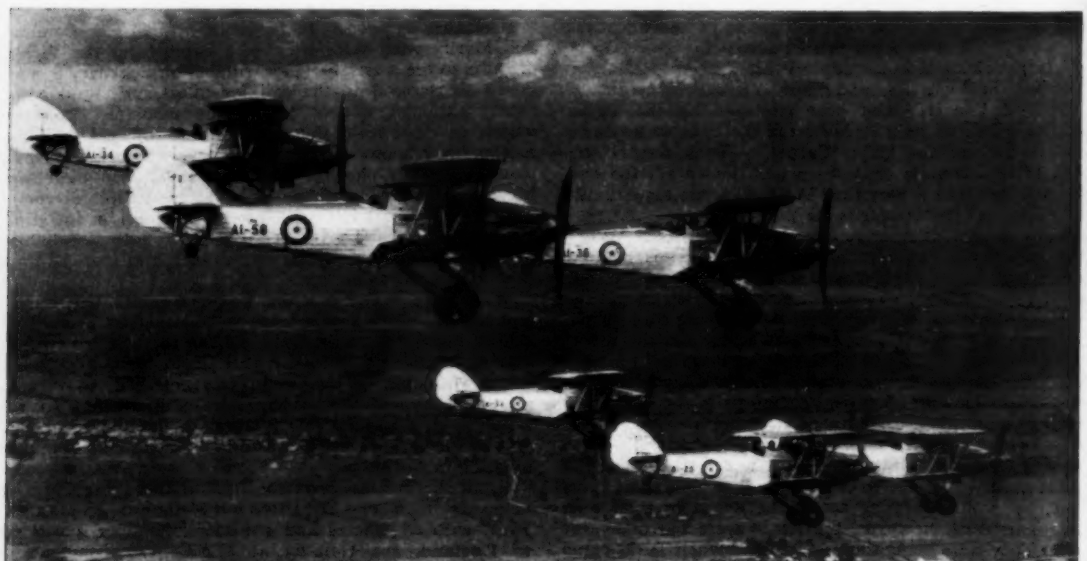
Civil aviation, after inevitable teething troubles, went ahead at first slowly, but latterly with remarkable impetus. In contrast, those who remained with post-war A.F.C. endured difficult times almost till a year ago. Year by year the Air Force vote was cut. Some people even queried the need for it at all. After 1919 the unit became known as the Australian Air Corps, then the Australian Air Force, but not till April 1, 1923, was the prefix "Royal" granted. It marked the inception of the force which to-day has sprung so keenly and loyally to the assistance of the mother country and her own R.A.F.

Conditions, organisation, ranks are practically the same in both forces. Officers' hat badges and the motto are the same as the R.A.F, but R.A.A.F. airmen have the letters R.A.A.F. cast into the hat badge. About the only marked difference is that the R.A.A.F. wears a royal blue uniform instead of the air force blue to which folk have become accustomed in this country. In a Strand bus the other day I overheard one fellow ask another:

"What's that . . . Navy air wing?"

They had seen Group Capt. McNamara and Sqn. Ldr. Creel, of the London Liaison Office, walking by and had been puzzled by the almost navy blue of their uniforms.

The force is administered by a board of three R.A.A.F. men and a finance member, with headquarters in Melbourne. Co-operation with the Navy and Army, training



Over the Commonwealth, two flights of Hawker Demons.

of personnel and all air defence matters are in their hands. They control the Point Cook training school, the squadrons based at Laverton, near Point Cook, and at Richmond, near Sydney, not forgetting the amphibian squadron attached to the R.A.N. At least these used to be their only centres of interest, but with the disquiet which has assailed Australia since Munich, and with the enormously enlarged defence programme since the present war broke out, many additional bases have been and are being equipped. Canberra, Perth, Darwin and places along the Queensland coast are but a few of the new spots where R.A.A.F. machines are being spread about the Commonwealth.

Between wars the policy, which has proved sound, has been to build up ground equipment, but not to acquire aircraft beyond immediate training needs. Insufficient funds for all purposes have dictated this. The result, before rearmament began, was fine stations at Laverton and Richmond with appliances installed and preparation made for operating the latest aircraft, their repair and the storage of usual spares. Moths, Bulldogs and Wapitis were, however, the latest available for pilots till Avro Ansons came along not long before war came, too. Since these hangars and repair shops and quarters have been established in advance it has been relatively simple for the R.A.A.F. to put the latest machines into service. Canvas hangars and Nissen huts, even as a wartime emergency, have not been part of the post-war economy of this force.

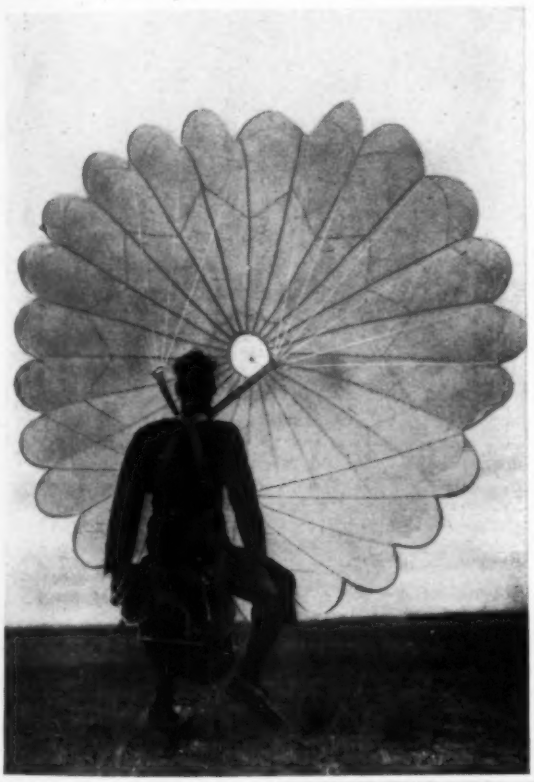
Many curious tasks have been handed to the Air Board under the plea that they would be good training in cross-country flying and suitable preparation for active service. These queer peacetime jobs have included mineral survey in the northern territory and rescuing stranded gold-seekers, miles from settlement. In 1928 C. T. Madigan, of the University of Adelaide, borrowed two Wapitis to explore Simpsons Desert from the air. He and the crews were the first white men to examine thoroughly this most pitiless portion of the arid interior. During the expedition they skimmed the gleaming white surfaces of salt lakes and dropped heavy spears to determine, by their penetration, how dry the salt was and how thick. Beneath that crust lay green ooze of unknown depth. As the spears stuck upright and did not pierce the crust, the pilots touched down on the surface at flying speed but wisely did not try to land.

Photography and Survey

Oblique and vertical photographs were taken also of the western Macdonnell Ranges. These and compass survey of this hitherto improperly mapped range system added greatly to our understanding of this backbone of Central Australia. When Kingsford-Smith, in 1930, was lost at the Glenelg River, Anderson and Hitchcock went after him but were forced down by engine trouble in the desert near Wave Hill. Again the R.A.A.F. was called out. Under Squadron Leader Eaton machines scoured the environs of Alice Springs looking for tell-tale smoke which would attract them to the wrecked machine. Eventually, Brain, who had flown over from Queensland, found the lost aircraft and the two men far from their intended course.

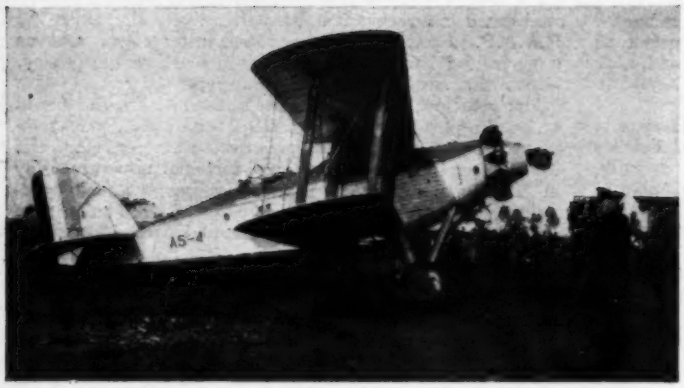
One expedition after another has disappeared into the sandhill desert west of Alice Springs, searching for a fantastically rich gold reef which Lasseter said he could re-discover. One by one they have got into trouble, and each time Eaton was torn from the comfort of Laverton to wrestle with a problem remote from civilisation. He found one grounded machine near Alice Springs and assisted in rescuing Paddy Whelan from a salt marsh north of the Transcontinental Railway. This gold hunter persuaded his backers to send him out in an aeroplane which unfortunately burst an oil pipe and had to land on the incompact surface of a dry salt marsh. As Baker could not rise with Whelan aboard, he left him there. R.A.A.F. machines supplied him with food and water until eventually Baker landed again, instead of waiting for a land rescue party. Lightly loaded this time, he flew Whelan back to Forrest.

About two years ago the R.A.A.F. was told to fly



(Above) A cadet of the Point Cook school at parachute practice. The school was established about twenty miles from Melbourne in the early days of the last war.

(Right) Anti-aircraft practice, another Point Cook picture. This school remains the principal training centre in Australia and has been busy with the personnel to man the six squadrons of the expeditionary force.



Wapitis did good service until the Ansons arrived. Leggings, as on the right, are unknown in our R.A.F.

geologists about the remote parts of the far North as these gentlemen wanted to study rocks and to photograph them as part of a mineral survey campaign to assist gold and mineral hunters. They were also told to fly the Adviser on Development from one centre to another all over North Australia. In the course of this the pilot overshot his mark, the tiny gold field at Tanami, about 400 miles nor'-west of Alice Springs. He ran out of petrol before he could locate his bearings or reach home. So they landed on a hard, dry salt lake and had official Australia in a flurry for some time. Their weak wireless signals from the ground were insufficient to locate the machine, and so R.A.A.F. machines had to scour a wide area till the grounded 'plane was observed. Then a land party reached it with petrol and food, and all was well. The happy ending to a week's thrill for the papers.

The force has also assisted in a fishery examination which the Commonwealth undertook to determine what sorts of fish swam where and to learn something about the movements of the shoals. The Japanese pearl-poachers along the coasts of Northern Australia have also meant work for R.A.A.F. pilots. The little men from Nippon have been dodging outside the three-mile limit when the patrol motor boat comes along, having been warned by smoke signals sent up by wild blacks watching along the shores. Australian pearlers have been suffering through the illegal competition of the Japanese luggers and at last, after considerable pressure from Darwin, the Federal Government allocated machines to patrol the coast as well as the "Larakeeya." I do not know that they have made a capture, but undoubtedly the presence of aircraft must have hindered the elusive poachers.

Although there had been a slight acceleration of interest in and expansion of the R.A.A.F. during the two years prior to Munich, the force had to wait for the Three Year Rearmament Plan which that crisis mothered before the real expansion started. Thoroughly modern machines distributed at additional points as far distant from Melbourne headquarters as Perth, in Western Australia, and Darwin, in the Northern Territory, inevitably brought for review again an earlier proposal to manufacture aircraft in the Commonwealth. Assured of a contract for forty Wirraways (Australian adaptation of the North American N.A.33) the Commonwealth Aircraft Corporation went into production eighteen months ago. Now Harold Clapp, who has modernised and straightened out the State railways of Victoria and given us the "Spirit of Progress" (streamlined, air-conditioned, all-steel, non-stop express from Melbourne to Albury) is Number One of a greatly enlarged factory. Bombers, fighters, trainers should issue from the Fisherman's Bend works at the rate of 800 a year in about a year from now. That is expected to be the peak production.

In addition, the market in the U.S.A., closed pending revision of the Neutrality Act, can now be counted in the scheme of equipment. 150 Lockheeds are on order and, from Great Britain, 150 trainers, 350 airframes and 500 engines are expected. This, mind you, on top of a present domestic weekly output of six Wirraways.

Now that the Empire Training Scheme, with headquarters in Canada, has been set in motion, the original offer of four bomber and two fighter squadrons which the Dominion made to Britain has been withdrawn. The new channel of support for the mother country will involve them in a contribution ten times as great. Some idea of the enormous burden which the Commonwealth Government is taking upon its loyal shoulders, on behalf of less than seven million people, can be pictured by comparing the 18 million pounds spent in the first year of the first German War and the planned expenditure for the first year of the second German War, i.e., 59½ million pounds.

What first-line strength of aircraft this will place at Australia's command and how many men will be required to fly and maintain them one cannot predict without intimate knowledge of how the R.A.A.F. portion of this vote will be spent. Even if one did try to work it out, possibly that gentleman with the blue pencil would censor the figures. Let it suffice that the R.A.A.F. vote was just less than two million pounds for 1937-38 and that it maintained 2,578 officers and men, as well as 399 members of the Citizen Air Force, which is the voluntary second line of air defence. They manned seven landplane squadrons and one amphibian squadron, amounting to 96 first-line aircraft. Now the Salmond Scheme for 193 first-line aircraft, with reserves in proportion, has been completed, and at least 600 pilots and airmen have been enrolled. This expansion is, nevertheless, a mere stepping stone in the wider part planned for the R.A.A.F. now that the nations of Europe have taken to the sword again.

The next evidence which the people of Britain will have that their cousins from down under are actually in the war—the first sight of them in arms—will be when the personnel arrives to man the unit to be formed with nine Sunderland flying-boats. These machines have been bought by the Australian Government which, instead of moving the Sunderlands to the Dominion, is sending 183 officers and men to operate over here.

Last time Australia was the only Dominion to have her own flyers in the air, and this time she is determined to maintain her lead by getting them here first!

Rome to Rio

THE newly formed Italian Transcontinental Air Lines plans to open shortly an air service across the South Atlantic, between Rome and Rio de Janeiro. The route will be laid via the Cape Verde Islands. Bruno Mussolini, the son of the Duce, is on the board of directors.

Not a U-boat

PAN-AMERICAN AIRWAYS' flying boat *American Clipper* met with a slight mishap the other day when taking off from Port Washington for Lisbon. The machine struck some floating object in the water and was forced to abandon the flight. The eight passengers suffered no harm.

Look After Your Car

THE AUTOCAR has issued an addition to their well-known series of handbooks under the title of "Look After Your Car." Written with all the knowledge and experience of the Autocar technical staff, it is at once informative and readable. In fourteen chapters it deals in considerable detail with every phase of car maintenance which comes within the ability of the average private owner. To use an expression appearing in one of the earlier chapters, "it shows an owner how to keep his car young"—a very desirable thing in these days of rigid economy.

Profusely illustrated throughout, the price is 2s. 6d. net, or 2s. 9d. by post, from *The Autocar*, Dorset House, Stamford Street, London S.E.1.

GERMANY'S AERO-ENGINES

The Cult of the Inverted Vee : "General Purpose" Radials : The Junkers Diesels

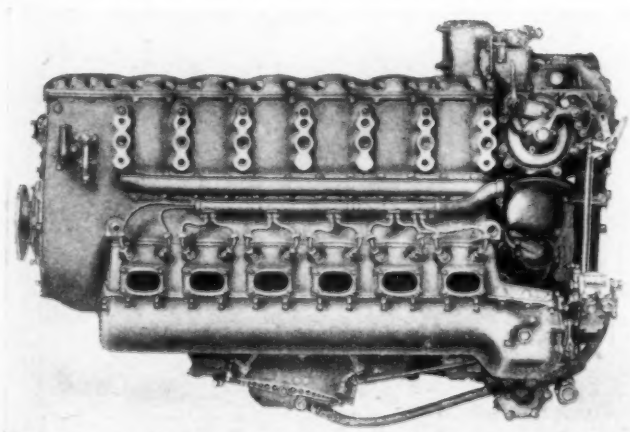
The installation of the Daimler-Benz DB 600 in a Messerschmitt Me 109 fighter.

THE International Meeting at Zürich in 1937 marked the debut not only of two of Germany's most formidable military aircraft (Me 109 and an improved Dornier Do 17), but of some new high-performance aero-engines—the Junkers Jumo 210 and the Daimler-Benz DB 600. By this time it had become apparent that German aero-engine development was evolving along predestined lines. Obviously, the policy was to use inverted vee-twelve liquid-cooled units in high-speed fighters and bombers; nine-cylinder air-cooled radials for general-purpose aircraft; and the water-cooled Junkers Jumo diesels for machines from which exceptional range or economy was desired. Thus the Jumo 210 inverted-vee appeared in the first Messerschmitt fighter, the little Hamburger dive-bomber, and certain other comparatively fast machines, while the DB 600, a larger unit, was installed in a modified Dornier Do 17, in a development of the original Me 109, and in the first Heinkel 111Ks. The B.M.W. radials were mounted in the Arado 95 general-purpose biplanes and other unspectacular, though essentially useful, aircraft.

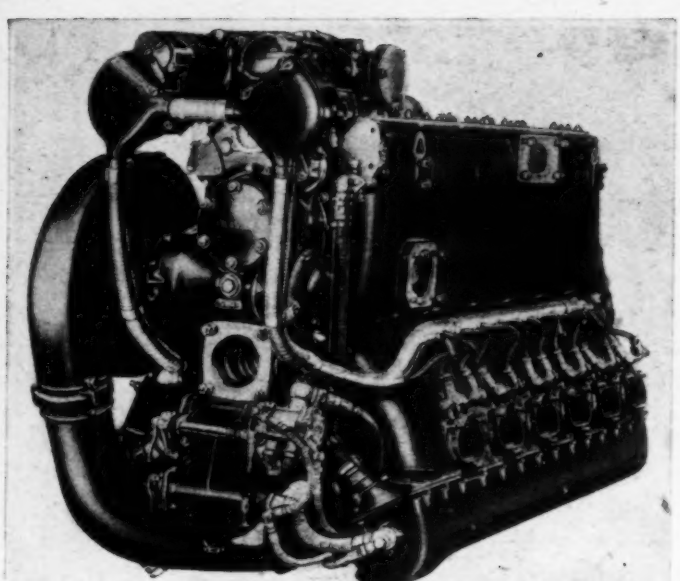
In its earliest days the *Luftwaffe* was able to make use of only one type of liquid-cooled engine. This was the B.M.W. VI upright vee-twelve which was standardised in the first Dornier Do 17s, the Heinkel seaplanes, and the Arado and Heinkel biplane fighters. This was a good all-round engine, but was heavy for its power and lacked the important refinement of supercharging. It was available with three compression ratios, the maximum output ranging from 650 h.p. to 750 h.p. at low altitude for a weight of 1,250 lb. in its geared form. It was not to be wondered at that Germany acquired a number of Rolls-Royce Kestrels for installation in prototypes until such time as the first crops of inverted-vees appeared in the Junkers and Daimler-Benz factories.

The first unit of this type to become available was the Junkers Jumo 210. This engine was built to meet a specification for a 20-litre unit giving 700 h.p. at sea level for a specific weight of less than 1.676 lb./h.p., the power to remain constant up to 10,000ft. Small overall dimensions were also required.

Essentially, the Jumo 210 (the engine is still quite widely employed) is a twelve-cylinder inverted-vee with the cylinders set at 60 degrees. This layout was adopted to give not only low head resistance, but a good field of view when installed in a fighter or dive-bomber. Like our own air-cooled Gipsy Twelve, it can be installed behind the hub of a three-bladed controllable-pitch airscrew. Actually, the capacity is 19.7 litres. The chief structural features are



A Junkers Jumo 210 inverted-vee twelve as installed in the earlier type of Messerschmitt single-seater fighters.



The Daimler-Benz DB 600 12-cylinder inverted-vee engine, showing the unusual mounting of the centrifugal supercharger.

steel cylinder barrels which are pressed into light-alloy blocks; a heavily ribbed box-shaped crankcase with detachable top; and an eight-bearing crankshaft. The pistons are of light alloy, and the cylinders have one inlet and one exhaust valve each; these are worked by "underhead" camshafts and rockers.

Rated on 87-octane fuel and fitted with a two-speed supercharger, the Jumo 210 delivers 640 h.p. at 2,700 r.p.m. at 14,800ft., and when used with a variable-pitch airscrew gives up to 690 h.p. for take-off. With a single-speed blower the maximum output for five minutes is 600 h.p., and the maximum continuous cruising power is 540 h.p.

D.B. 600

Produced at about the same time as the Jumo 210, the Daimler-Benz DB 600, a Mercedes product, was laid out along similar lines, although it was a considerably larger unit and differed in detail.

Of 33.9 litres capacity, the DB 600 measures 28.03in. across the cylinder block and is about 68in. long. The steel cylinder barrels are shrunk and screwed into blocks of silumin-gamma alloy. This latter material is also used for the crankcase, which is in one piece and has seven steel-backed lead-bronze bearings for the crankshaft. Each cylinder has two inlet and two exhaust valves per cylinder. The first models had a single-speed centrifugal supercharger mounted fore and aft to the rear of the engine on the port side looking forward. The pressure carburetter is between the cylinder banks, and there are one pressure and two scavenge oil pumps. Ignition is by two Bosch magnetos.

Two versions of the DB 600 were put into production. The first was a medium supercharged type which was rated 910 h.p. at sea-level, the take-off output being 1,000 h.p. The second (fully supercharged) type gave 920 h.p. at 2,400 r.p.m. at 13,100ft., the take-off power being 950 h.p.

Jumo 211

At the Milan Show in 1937 the Junkers Company introduced a new type of large inverted-vee petrol engine which was soon to appear in large numbers in aircraft of the *Luftwaffe*. This was the Jumo 211, and bore the same relationship to the Jumo 210 as does the Rolls-Royce Merlin to the Kestrel, or Peregrine.

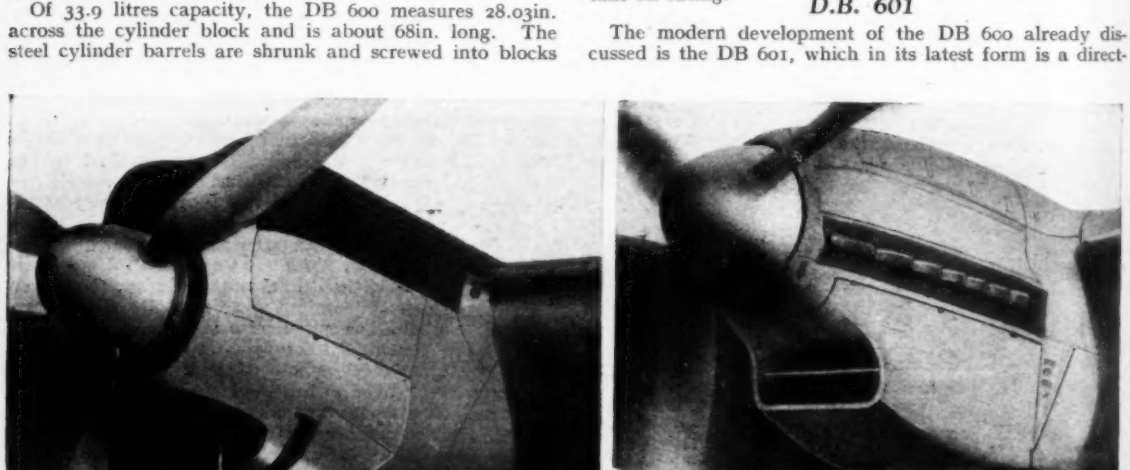
The Jumo 211 is of slightly larger capacity than the DB 600, the actual figure being 35 litres. Width and length are about 80in. and 67in. respectively, and the empty weight in the neighbourhood of 1,300 lb. In general design the engine resembles the Jumo 210.

It is known, however, that at 13,800ft. a maximum power of 975 h.p. is available for five minutes at 2,300 r.p.m. A two-speed supercharger is incorporated, and the unit has lately been rated on 100-octane fuel. Modified for direct petrol injection, in which form the engine is at present in production, it is known as the type Ba or Da, the differences between the units being concerned only with reduction gear ratio. A set of twelve injection pumps is fitted between the cylinder banks.

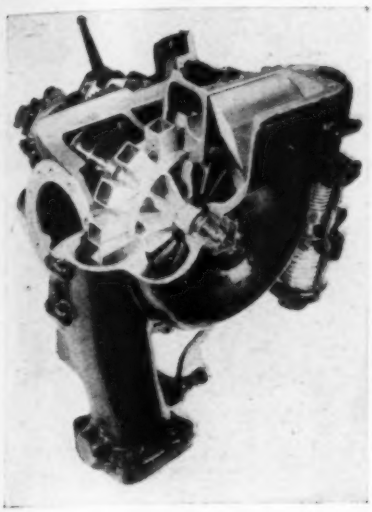
The Junkers Company commonly quotes a power of 1,200 h.p. for the latest Jumo 211. This is undoubtedly a take-off rating.

D.B. 601

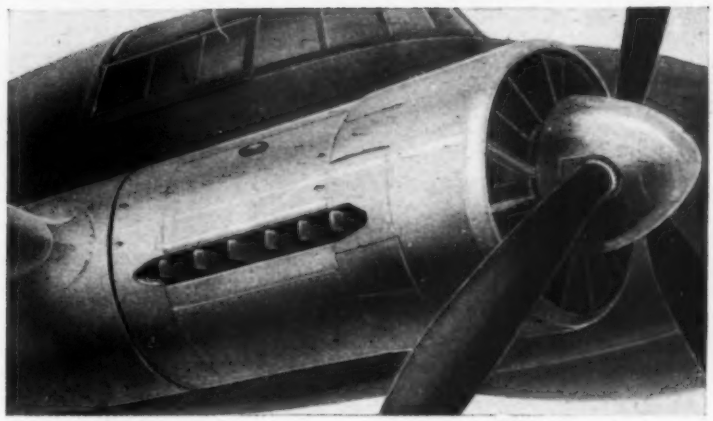
The modern development of the DB 600 already discussed is the DB 601, which in its latest form is a direct-



On the left the B.M.W. VI Prestone-cooled upright vee-twelve, as installed in the earlier Dornier Do 17. On the right, a Daimler-Benz DB 601, as fitted in the newer Dorniers. Note the rearward-facing exhaust stubs.



The two-speed supercharger of a Junkers Jumo 210. The automatic boost control is shown on the side.



In the upper picture is shown the latest installation of the Junkers Jumo 211 in the Ju 88 high-speed bomber. When a large-diameter spinner is used, the cowling of the DB 601 inverted-vee twelve is by no means unsightly, as shown in the lower view of the nose of a Heinkel He 112U.

injection type. It is essentially similar to the DB 600. One of the latest models shown at the Brussels Show was the DB 601 Aa. The maximum power of the engine is 1,150 h.p. at 2,400 r.p.m., but for use in the record-breaking Messerschmitt, which attained 469.225 m.p.h., it was boosted to give 1,800 h.p. at 3,500 r.p.m.

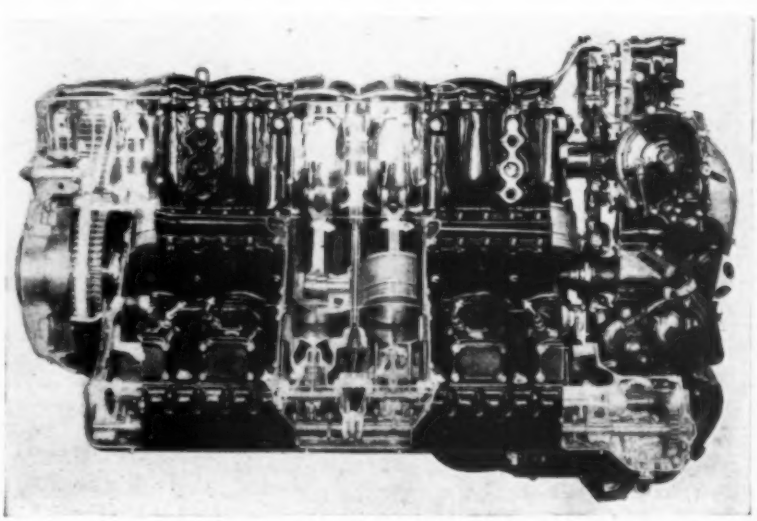
There have been reports of a large X-shaped Daimler-Benz engine of about 2,000 h.p., which must be assumed to be a developed combination of two DB 600s. Contrary to rumours, this engine was not installed in the Heinkel and Messerschmitt record-breakers.

The Junkers works are deserving of great credit for having evolved the Jumo 205 heavy-oil engine, which must be admitted to be the only diesel engine to have proved itself suitable for every-day civil and military service.

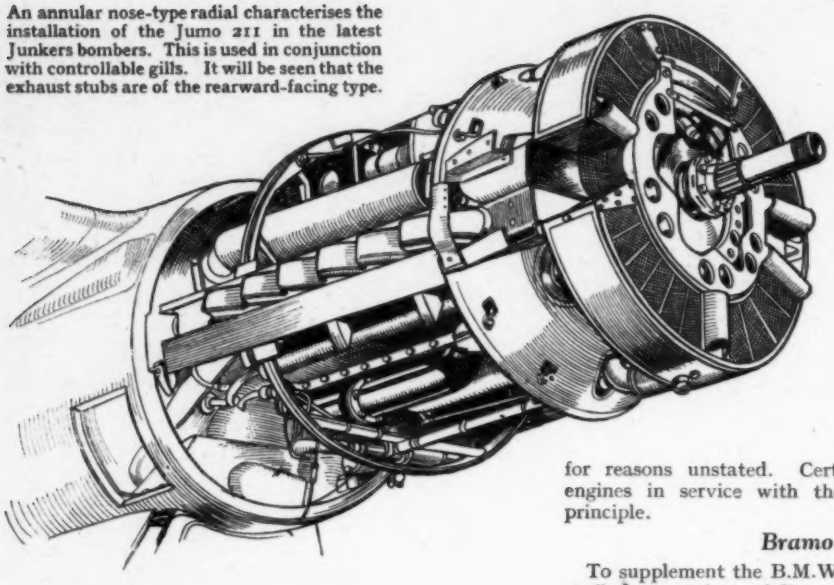
Actually, the first Jumo 205 was put on the test bench in December, 1932, and in the middle of the following year was installed in an aircraft for tests. By 1933, 16,000 miles had already been flown with units of this type, and by 1937 Deutsche Lufthansa had logged a total of 1,025,000 miles on aircraft fitted with Jumos. A consumption as low as 0.346 lb./h.p./hr. was recorded for Jumo 205s installed in a Dornier Do 18 flying-boat which flew 5,220 miles from Start Bay, Devon, to Caravellas, Brazil, in 1938. Despite these successes, the engine has been overshadowed for military use by the new inverted-vee Junkers and Daimler-Benz petrol engines, though it remains in service in the Dornier Do 18K flying-boats and a few of the older Junkers Ju 86K bombers. It is significant, however, that it is the standard power unit for the Dornier Do 26 long-range postal machine which may have been converted for military purposes. This aircraft mounts four Jumo 205s in tandem pairs.

Jumo 205

The Jumo 205, which is of 16.62 litres capacity, is an opposed-piston engine. The upper and lower crankshafts are connected to each other by a train of gears, and a reduction ratio is obtained between the crankshaft and the airscrew shaft. The piston operates the inlet and outlet ports in the steel liners which are situated in the crankcase. Air is compressed in each cylinder between the two opposed pistons on their inward strokes, and the fuel is injected near their common dead centre and ignited by



A sectioned Junkers Jumo 211. This is the most powerful unit at present in service in the Luftwaffe and is fitted in the new Junkers Ju 88 bombers.



An annular nose-type radial characterises the installation of the Jumo 211 in the latest Junkers bombers. This is used in conjunction with controllable gills. It will be seen that the exhaust stubs are of the rearward-facing type.

A Junkers Jumo 205 diesel of the type used in the Do 18 flying boats and in the older Ju 86K bombers.

the heat of the compressed air. Before the end of the outward stroke, on which combustion and expansion occur, one piston uncovers the exhaust ports, and after a short time lag the other uncovers the inlet ports, through which a blower forces air with a spiral motion which scavenges the cylinders. As soon as both sets of ports are covered compression begins and the cycle of operations is repeated. The maximum output of the standard engine is 592 h.p. at about 2,000 r.p.m., the fuel consumption at normal output (510 h.p.) being between 0.353 and 0.375 lb./h.p./hr.

B.M.W. 132

For several years the B.M.W. concern (Bayerische Motoren Werke A.G.) has built the nine-cylinder Pratt and Whitney Hornet radial under licence, designating it the type 132. The latest versions, however, have been so modified that they are virtually new engines.

The most commonly used unit of the series is the 132 Dc which, like its companion types, is of 1,691 cu. in. displacement. Latest engine of the series is the 132 K, which has been developed for direct petrol injection and gives a maximum output of 1,000 h.p. The injector pump is carried on the rear cover with the accessories. Two large intake pipes facing forward between the cylinder banks feed air to the supercharger; and two butterfly valves, one operated by the throttle and the other by an automatic control, vary the amount of air taken in. To maintain a balance in the fuel-to-air ratio, an oil-operated servo mechanism, interconnected with the throttle, controls the fuel feed. Another control operates the second pair of butterfly valves already mentioned. An advantage of the direct-injection engine, besides the accurately metered fuel supply, is its ability to start at once from cold without priming. Experiments have been made at temperatures of 20 deg. C. below zero. It was rumoured, however, that engines already in service with direct fuel injection must be stripped down every twenty-five hours—for reasons unstated. Certainly a large percentage of engines in service with the *Luftwaffe* operate on this principle.

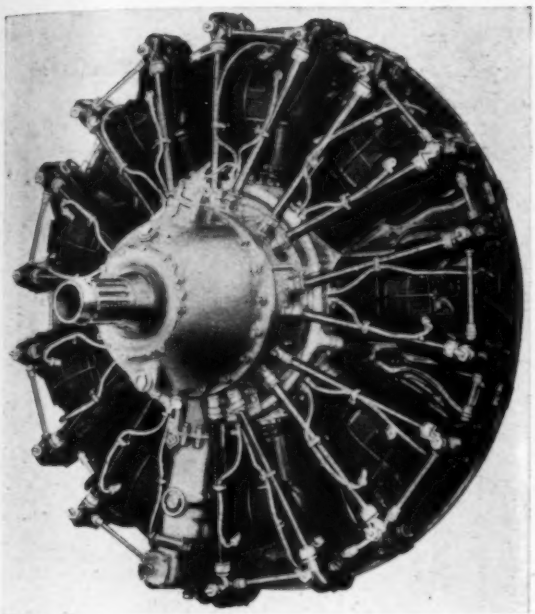
Bramo Fafnir

To supplement the B.M.W. 132 Dcs in service the *Luftwaffe* has numbers of Bramo Fafnir nine-cylinder radials. The Fafnir, or type 323, first appeared in public at the Milan Show in 1937. It is a wholly German product, and is used in fully and medium supercharged forms. A built-up, two-piece crankshaft is used; this carries a one-piece master rod with eight articulated rods. The supercharger impeller speeds for the fully and medium supercharged engines respectively are 11.4 and 9.5 : 1 respectively.

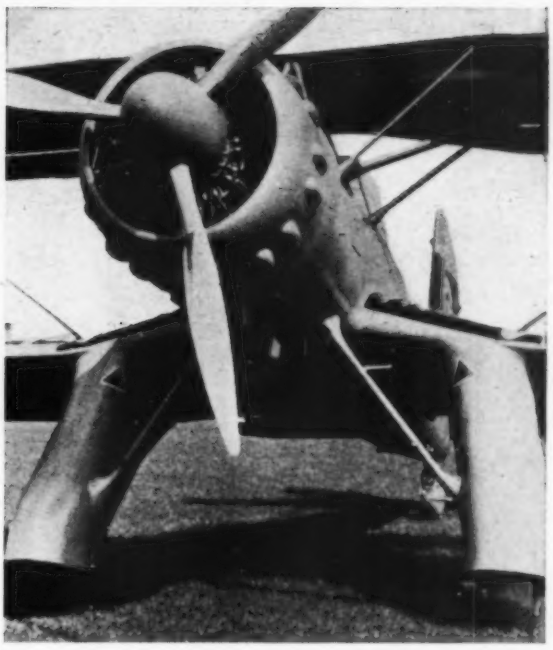
Heating from the exhaust gases is provided for in the Pallas duplex carburetter, which has automatic boost and altitude controls.

The capacity is 26.82 litres, the compression ratio 6.4 : 1 and the diameter 1,388 mm. The moderately supercharged version gives 950 h.p. at 2,450 r.p.m. for take-off and 670 h.p. at 2,100 r.p.m. at 6,730ft. for cruising. In fully supercharged form the take-off power is reduced by

The installation of a Jumo 205 diesel in a Junkers Ju 86. The airscrew is a V.D.M. electrically operated type.



A widely used radial is the B.M.W. 132 Dc. It is the counterpart of our Bristol Pegasus but is not so powerful.



The installation of a B.M.W. 132 Dc radial in an Arado Ar 95 general purpose biplane.

90 h.p., but 665 h.p. is available for cruising at 13,750ft. It is believed that a two-speed supercharger has been developed for this engine. The new direct-injection version has its pump on the rear cover.

Interchangeability

The Junkers concern has done a great deal of work toward perfecting standardised power units. It is stated that this was instigated by Deutsche Lufthansa, but doubtless the *Luftwaffe* has benefited very considerably.

The Junkers standard unit as applied to the B.M.W. 132 radials is secured to the airframe by four spherical screw couplings, and the various types and control rod connections are easily effected. For this purpose the pipes conveying fluids are grouped, and their connections positioned and marked for ready identification. The joints are arranged around the circumference of the fireproof bulkhead. It was found to be better not to use a common coupling for several pipes, but to provide individual connections for each of the pipes, with a device which automatically seals the pipe ends when the connection is uncoupled. A special clip is used as a single locking device for all the pipe couplings.

In the B.M.W. 132 installations, the oil tank is included in the unit. Electrical cables are connected to the main installation by pin plugs, and quick connectors have been developed for all control cables and rods.

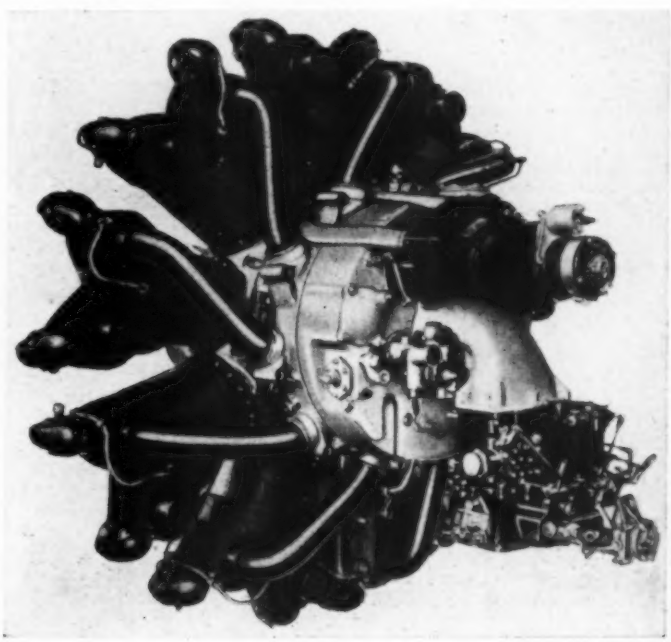
It was necessary, of course, to devise a quick connection for exhaust pipes and fresh air pipes penetrating the fireproof bulkhead. As the hot exhaust gases were wanted for heating purposes the possibility of exhausting directly to atmosphere forward of the bulkhead had to be abandoned. The long-chord cowling with controllable gills has been designed to be quite independent of the various types of aircraft.

At a civil demonstration of the Ju 90 transport at Tempelhof Airport a complete change of power plant was effected in 26 mins.

In the main the cowlings of the German radial engines follow general practice in that they are of the long-chord type with controllable gills. On several of the B.M.W. 132 Dc installations the cowling is scalloped.

The cowlings for the liquid-cooled engines are more distinctive and vary considerably. Although they are much shapelier than those used for the old B.M.W. VI, which was characterised by a sharp hump made by the cylinder banks, they are, on the whole, considerably inferior to the cowlings used on our Spitfires, Hurricanes and Defiants. The shape of the crankcase still gives a hump effect, though as will be gathered from the illustration of the cowling of the He 112U, this is by no means unsightly when a large-diameter spinner is used.

(Continued on page 396.)



A companion type to the B.M.W. 132 Dc is the Bramo Fafnir which was the first big all-German radial to be installed in high-performance military aircraft.

HERE and THERE

Mr. F. McKenna, "Gloster" director.

A Popular "Gloster" Appointment

FLIGHT is happy to be in a position to announce the appointment of Mr. F. McKenna, M.I.Ae.E., F.R.S.A., to the board of directors of the Gloster Aircraft Co., Ltd.

Completing a quarter of a century in the aircraft industry this month, "Mac," as he is affectionately known, has held a number of important posts, all of which have carried considerable responsibility. Commencing with Avros at Manchester in 1914, and a move during the Great War to become a departmental superintendent with the British Nieuport Co., Ltd., at Cricklewood, he first joined the Glosters in 1922. After a period as production manager and, later, works manager (which would be the time Grebes and Gamecocks were being produced), he assumed the general managership in 1930.

Since 1930, especially during these last few years of high-pressure expansion, the Gloster Company has grown out of all recognition, and the burden of responsibility must have been very heavy. Enormous contracts for aircraft from original Gloster designs as well as from those emanating from other branches of the Hawker-Siddeley concern (of which Glosters are a part) have been completed or are in the process of manufacture. To have taken a major share in piloting a firm through such a period shows undoubted ability.

We offer our congratulations on the new appointment, which is as well earned as it is popular.

Lockheed's 250,000 Dollar Contract

THE first sale of the new Lockheed *Lodestar* commercial aeroplane was recorded on October 12. Three of these machines were ordered by Mid-Continent Air Lines, of Kansas City. Delivery is scheduled to take place next March, when the machines will be placed on the Minneapolis-Omaha-Kansas City-Tulsa route.

As announced in *Flight* recently, the first flights of the prototype machine were completed a few weeks ago. Since then the *Lodestar* has been undergoing manufacturer's and Civil Aeronautics Authority tests. It is expected that the Federal Approved Type Certificate will be issued very shortly.

GERMANY'S AERO ENGINES *(continued from p. 395)*

The B.M.W. VIs had prestone (ethylene glycol) cooling, but the new liquid-cooled engines have been developed for "pressure-water" cooling, like certain types of Rolls-Royce Merlin. It is believed that the pressures used in Germany are rather higher than those standardised in this country.

Perhaps the most interesting installation of a German inverted-vee engine is that used for the Jumo 211 engines in the Ju 88 bomber. This forms the subject of two of the accompanying sketches. The radiator is of the annular nose type and is used in conjunction with controllable gills. As on all the latest installations, the exhaust stubs are of the rearward-facing type which may give a small measure of thrust.

Foynes-Schiphol ?

IF negotiations now proceeding between the K.L.M. and Pan-American Airways do not fall through, and there is no reason to think that they will, we may soon see an extension of the transatlantic route from Foynes, Ireland, where the flying boats alight, to the Amsterdam airport at Schiphol. The extension will be operated by landplanes, of course, and there are rumours that Boeings will be used.

Stratoliner Nearly Ready

THE Boeing Aircraft Company, of Seattle, announces that the test programme set for the Stratoliner is nearing its conclusion. The 307 will then be passed on to the Civil Aeronautics Authority for official tests; these are expected to take several weeks.

Nine Stratoliners are being built at present. One is now in the hands of Howard Hughes, who is using it for special experimental flights in the Los Angeles area. Two others have been in the hands of Mr. Edmund T. Allen for some months. Mr. Allen is the Boeing company's director in charge of flight and research. Other machines of the series are in various stages of completion, and the passengers furnishings will not be installed until all tests have been completed.

So far the cabin pressure equipment has functioned satisfactorily on test. It maintains low-level air density at the operational height of 14,000-20,000 ft.

It may be recollected that in the experimental machine extra fin surface was added. This will be made a part of the permanent structure of the production models, as it has been found to have a marked effect on direction stability. Other features which result from the extensive flying tests, and which will be incorporated in the production machines, are leading-edge slots near the wing tip, increase in the span of the landing flaps, and improved streamlining of the fillets between wing and fuselage.

BOOK REVIEWS

"Lighter Than Air," by Stephen Wilkinson, A.F.C., F.R.I.B.A., with a Foreword by Maj.-Gen. E. B. Ashmore, C.B., C.M.G., M.V.O., 6s. (Arthur H. Stockwell, Ltd., 29, Ludgate Hill, London, E.C.4.)

DURING the war, balloon observers and airship officers were put through a preliminary course in free balloons, and the author of this book was one of the instructors in charge of this operation. An architect in civil life, he became a very expert aeronaut, and was granted the Air Force Cross for his services.

Very little has been published about this side of war work, and Mr. Wilkinson gives a welcome and interesting account of the business, its fascination and its risks. The book would be more attractive if he did not split quite so many infinitives and did not overdo the use of inverted commas with ordinary slang expressions. None the less, it is a book which can honestly be praised, and is a useful contribution to war literature.

Simpler Still

"A Primer of Flying," by G. W. Williamson, O.B.E., M.C.; 2s. 6d. "Flying Simply Explained," by Malcolm Logan; 6d. Pitman.

IT is extremely difficult to explain "how to fly," even when the printed word is assisted by innumerable diagrams. The whole thing is made to appear either too simple or so complicated that no reader would dare to go out and try for himself or herself.

These two books suffer, if anything, from the first fault. It is impossible to explain the control processes involved in flying; they are much too complicated. And diagrams drawn in two dimensions often tend to defeat their own object. The most that can be said for any such books is that they can give a good if hazy idea of the principles involved—thus saving the unfortunate instructors' time.

Of the two, Wing Cdr. Williamson's is, rather naturally, the more complete. He explains blind-flying instruments, but does not, as Mr. Logan, mention the uses and disadvantages of the trailing-edge flap. Mr. Logan's book is, in fact, merely a "re-hash" of the latest instructional patter. Even some of the expressions are identical, and the incorrectly simplified explanations are repeated. Has it ever been worked out *just* how much faster the outer wing travels in a turn in order to "obtain greater lift"?

However, books of this type must be written for the benefit of the novice and the simpler they are, the better.

EXHAUST EFFLUX PROPULSION

By F. W. LANCHESTER, LL.D., F.R.S.

The Famous British Pioneer of Aerodynamic Science Discusses the Fundamental Principles of Auxiliary Propulsion

Dr. Frederick Lanchester.

THE subject of auxiliary propulsion by exhaust efflux has lately come into prominence; it is of no less interest to the internal combustion engineer than it is to the aeronautical constructor and designer. It is to be regarded as a means of utilising energy which usually goes to waste.

In the old days when the Otto cycle engine was first introduced, the fact that exhaust release took place at a pressure from some thirty or forty pounds per square inch above atmosphere was much criticised, it being thought to be wanton extravagance; it was imagined by engineers of that period that, just as in the steam engine, means would be found to provide a further stage of expansion and so utilise the energy which was going to waste.

Early Experiments

One of the early pioneers, James Atkinson, introduced in succession two different types of engine, in which the expansion of the charge was carried beyond its initial volume. First came his "differential" engine, 1885, and a year or two later the Atkinson so-called "cycle" engine made its first appearance, but neither of these remained for long in production. Then, some years later Atkinson, in collaboration with Messrs. Crossley Brothers, Ltd., struck out in another direction; he abandoned the idea of extended expansion, and made use of the efflux energy to induce scavenging, i.e. to replace (by suction) the residuary products of combustion by fresh air, prior to the induction stroke. The writer believes that in no case did Atkinson propose or make use of *Compounding* as a means of continuing the expansion; this, however, was attempted by Dugald Clerk, who for a time believed that the solution would be found in that direction: his efforts were not successful. Other engineers are known to have made similar attempts. Then came a surprise. Dugald Clerk introduced supercompression, otherwise known as supercharging, with the result that the exhaust release pressure was higher than before. Clerk put forward more than one proposal to utilise the exhaust to provide the energy for the supercharge; he claimed to have obtained increased economy by supercharging *with exhaust gas*, a claim which subsequent experience did not altogether justify.

More recently attempts have been made in another direction to capture some of the energy going to waste, this time to recover and utilise the waste heat for the raising of steam. This system applied on a large scale has proved of commercial utility, but the mention of it here is a digression.

Of recent years exhaust pressure has been applied to the driving of a turbo-fan—a combination of an exhaust gas turbine and a compressor, by which means a certain degree of supercharging may be secured; this, we may say, is a practical development of the ideas first promulgated by Dugald Clerk. The writer, about the year 1904, applied a similar device to the air cooling of an automobile engine, the exhaust pressure being tapped from ports in the cylinder wall overrun by the piston at about three-quarter stroke. This did not go beyond the laboratory stage; it made a terrible noise, and was written off as a failure.

Now, last of all, comes the proposal, only of value in its application to aircraft,* to use exhaust efflux directly as an auxiliary means of propulsion. The great attractiveness of this proposal lies in its extreme simplicity, and in the fact that it may be carried into effect with but little increase in weight or cost. It can only be applied with effect to aeroplanes or high-speed racing cars, on account of the fact that high speed is essential if the method is to be effective. The essential is that the speed of flight shall be of the same order of magnitude as the velocity of the efflux gases:† the higher the better.

Two Distinct Problems

There are, both in the theoretical aspect and the practical working out, two distinct problems to be dealt with, characterised by two entirely different sets of conditions. (1) When the exhaust release pressure is utilised to the full without involving back-pressure during the return or evacuation stroke. And (2) when the efflux energy is wholly or in part due to the piston (or pistons) during the return stoke, and in which there is consequent back-pressure. These two problems need to be considered separately.

In order to deal intelligently with the subject it is necessary in the first instance to take account of certain principles which are involved in the flight of a rocket. The propulsion of a rocket differs fundamentally from that of an aeroplane or ship; although in both the propulsion is derived as a reaction due to the continuous communication of momentum to gaseous matter in a

(*Continued on page d*)

* And perhaps to high-speed cars intent on record-breaking.

† The same considerations applied when M. des Bleds endeavoured to drive a canal barge with an airscrew. This was foredoomed to failure because the velocity of the slip stream was far greater than that of the barge. To give economical results the screw propeller would have needed to be of about the diameter of an average wind-mill!

NOW AVAILABLE AS A WALL CARD, SIZE 14½in. x 22½in. Price 1s., postage 5d.

FLIGHT IDENTIFICATION CHART of GERMAN AIRCRAFT

This chart and the set of drawings are the copyright of the Flight Publishing Co. Ltd., Dorset House, Stamford Street, London, S.E.1. Copies may be obtained One Shilling each, postage fingerprint extra.

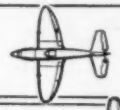
THESE copyright studies enable ready recognition of the principal types of enemy aircraft. In addition to broadside, head-on, overhead and underside views in which the chief characteristics are depicted, they are also detailed in the text to assist identification.

HEINKEL HE 112 U

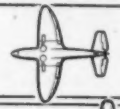
SINGLE-SEATER FIGHTER

ARMAMENT: Unknown, but probably one shell-gun and two machine guns

Finely streamlined fuselage; retractable undercarriage; "inverted gull" wings; water-cooled inverted vee-twelve engine.



Elliptical plan form, with pronounced pointed wing tips; single fin and rudder are shown in this overhead view.

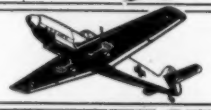


This underside view shows that the undercarriage wheels retract inwards.

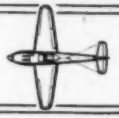
MESSERSCHMITT ME 109

SINGLE-SEATER FIGHTER

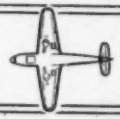
ARMAMENT: Four machine guns and possibly a shell-gun



Powered by a vee-twelve engine, this machine is slightly larger than the ME 112 U. The fin and rudder are not so tall as those of the Heinkel.



Straight-tapered wings with comparatively square-cut wing tips are a features of the ME 109 as seen from above.



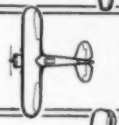
The undercarriage wheels of the ME 109 retract outwards. The tailplane is strut-braced to the fuselage.

HENSCHEL HS 123

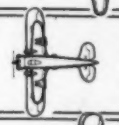
SINGLE-SEATER FOR DIVE-BOMBING, GROUND ATTACK AND FIGHTING

ARMAMENT: Two machine guns and bombs

Biplane of unequal span, with single interplane struts on each side; fixed undercarriage with spats; single large radial engine.



Overhead view of the HS 123, showing single fin and rudder.

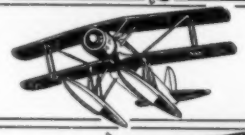


Unequal span of wings can be seen in this underside view. Auxiliary petrol tank slung beneath fuselage.

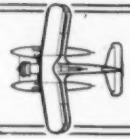
ARADO AR 95

TWO-SEATER FOR BOMBING, RECONNAISSANCE, TORPEDO DROPPING AND SMOKE SCREEN LAYING

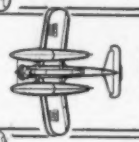
ARMAMENT: Two machine guns, bombs or torpedo



Twin-float seaplane with single radial engine. Torpedo slung beneath the fuselage, between the struts which support the floats.



Sharply swept-back wings and long cockpit enclosure visible in overhead view; single fin and rudder.

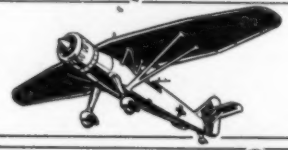


Underside view of the AR 95, showing the floats and the position of the torpedo.

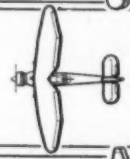
HENSCHEL HS 126

TWO-SEATER FOR ARMY CO-OPERATION

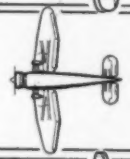
ARMAMENT: Two machine guns and light bombs



Parasol monoplane with single radial engine and fixed single-strut undercarriage. Note the sloping vee-shaped wing bracing struts.



The HS 126 in plan view. The "cut-out" in the centre of the wing improves the pilot's view.



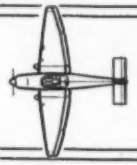
Underside view of the HS 126, showing struts which brace the wings and tailplane.

JUNKERS JU 87

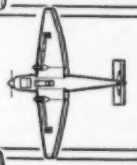
TWO-SEATER DIVE-BOMBER

ARMAMENT: Two or three machine guns and bombs

Low-wing monoplane with sharply "cranked" wings. Vee type water-cooled engine; fixed undercarriage with spats.



From above, the tapered wings and square-cut tail can be seen. Note the typical Junkers flaps and ailerons.



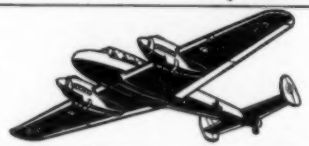
The air brakes used for dive-bombing can be seen in this underside view.

MESSERSCHMITT ME 110

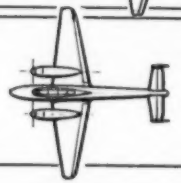
FOR FIGHTING, LIGHT BOMBING AND GROUND ATTACK

CREW: Two or Three

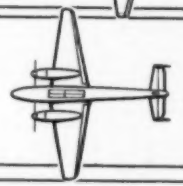
ARMAMENT: Two shell-guns and four machine guns



Twin-engined monoplane; slim fuselage, with transparent cover on top; no transparent window in nose; water-cooled vee-twelve engines.



Sharply tapering wings and long cockpit enclosure are revealed in this view from above.



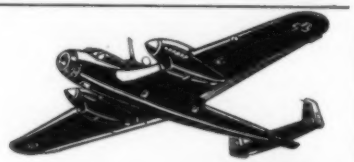
Note the monoplane tail with twin fins and rudders. The wheels retract into the engine nacelles.

DORNIER DO 17

FOR BOMBING AND STRATEGICAL RECONNAISSANCE

CREW: Three

ARMAMENT: Two machine guns and bombs

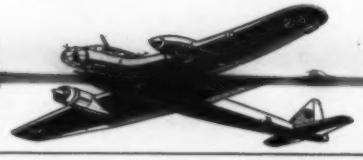


DORNIER DO 215

FOR BOMBING AND STRATEGICAL RECONNAISSANCE

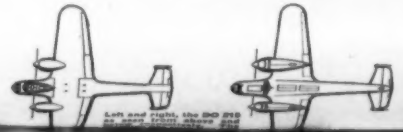
CREW: Three

ARMAMENT: Unknown, but probably three machine guns and bombs



Fairly short nose; engine nacelles extend well forward of the wings, almost level with the nose. Vee-twelve engines with circular nose radiators.

The DO 17 and DO 215 are based on the same design except for cockpit and gun arrangements. Whereas the DO 17 has one gun turret above the fuselage, facing aft, and one in the nose, the DO 215 has, in addition, a turret below the fuselage for firing down and aft. The engines fitted may be air-cooled or water-cooled.



Left and right, the DO 215 as seen from above and below. Note the single fin and rudder.

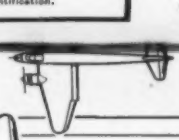
DO 215

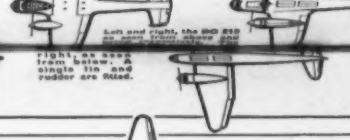
FOR BOMBING AND STRATEGICAL RECONNAISSANCE

CREW: Three

ARMAMENT: Unknown, but probably three machine guns and bombs

Fairly short nose; engine nacelles extend well forward of the wings, almost level with the nose. Vee-twelve engines with circular nose radiators.





Left and right, the DO 215 as seen from above and right, as seen from below. A single fin and rudder are fitted.

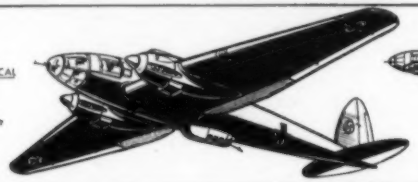
HEINKEL

HE 111 K

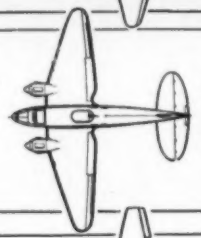
FOR BOMBING AND STRATEGICAL RECONNAISSANCE

CREW Three-Four

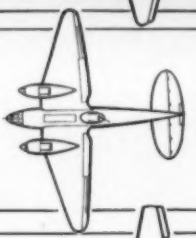
ARMAMENT Three machine guns and bombs



Perfectly streamlined fuselage with transparent nose. No separate cockpit for pilot. Vee-twelve water-cooled engines. Gun turrets above and below fuselage.



Swept-back wings with straight trailing edge and raked leading edge are features of the **HE 111 K** (View from above)



This underside view shows the lower gun turret and also the distinctive curves of the unbraced tail-plane.

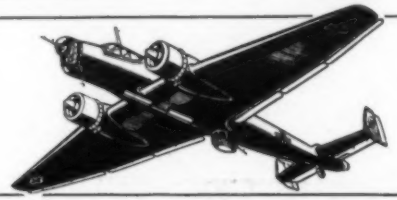
JUNKERS

JU 86 K

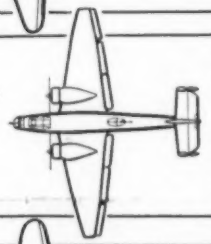
BOMBER

CREW Three-four

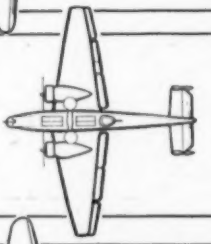
ARMAMENT Three machine guns and bombs



Gun positions in nose and above and under fuselage. Radial engines shown, but also fitted with diesel motors in flat-sided nacelles.



The views on left and right show the **JU 86 K** from above and below respectively. Tapered wings and prominent flaps and ailerons are distinctive features. The undercarriage folds outwards. Twin fins and rudders.



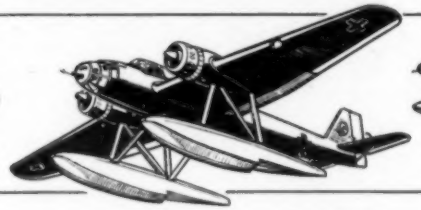
HEINKEL

HE 115

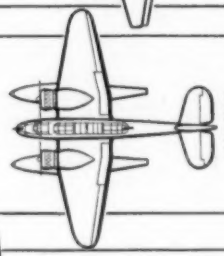
FOR TORPEDO DROPPING, BOMBING, RECONNAISSANCE AND PATROL

CREW Four

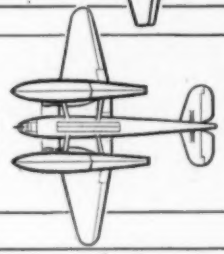
ARMAMENT Two machine guns and bombs or torpedo



Side and front views of the **HE 115**. A long cockpit enclosure and single square-cut fin and rudder are features. Radial engines are fitted.



From above can be seen the tapered wings and long cockpit enclosure of the **HE 115**. There is a single fin and rudder.



The **HE 115** as seen from below showing disposition of floats. Note the pronounced taper of the wings.

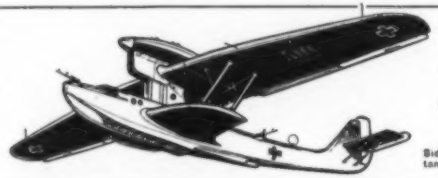
DORNIER

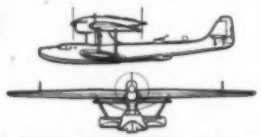
DO 18 K

FOR RECONNAISSANCE AND BOMBING

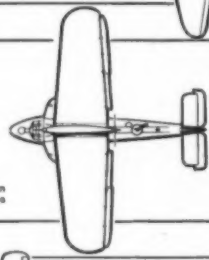
CREW Three-four

ARMAMENT Two machine guns and bombs

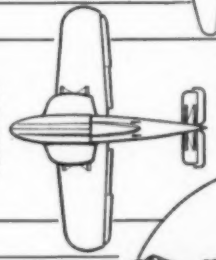




Side and front views of the DO 18 K. Diesel engines in tandem are mounted above the wing, and the latter is braced to the sponsons, or sea wings.



The tandem mounting of the water-cooled engines on the centre-line of the wing is seen in this plan view view from above of the **DO 18 K**.



The **DO 18 K** from below. The peculiar shape of the underside of the hull should be noted, and also the sponsons springing from the hull.

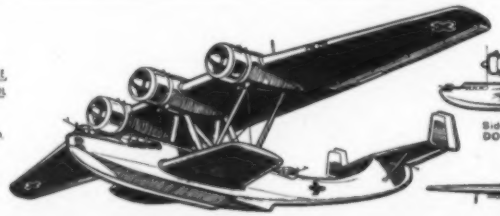
DORNIER

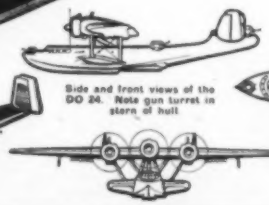
DO 24

FOR RECONNAISSANCE, BOMBING AND PATROL

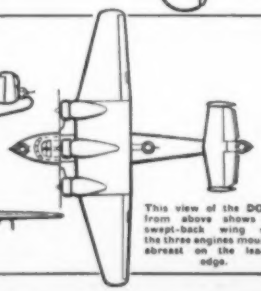
CREW Six

ARMAMENT: Unknown, but probably three machine guns

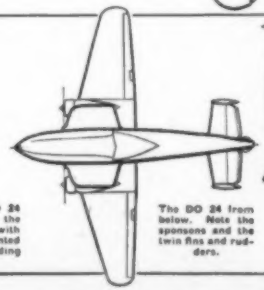




Side and front views of the **DO 24**. Note gun turret in stern of hull



This view of the **DO 24** from above shows the swept-back wing with the three engines mounted abreast on the leading edge.



The **DO 24** from below. Note the sponsons and the twin fins and rudders.

JUNKERS

JU 89

FOR BOMBING AND TRANSPORT

CREW Six Seven

ARMAMENT Probably four-five machine guns and bombs

EXHAUST EFFLUX PROPULSION (Continued from page a)

rearward direction, the propulsion of a rocket is characterised by a spending of the substance of the rocket itself, whereas that of an aeroplane or ship does not involve any loss of substance on the part of the body propelled, the momentum being communicated to a mass of free air or water as the case may be.

The Theory of the Rocket

Let V be the velocity of flight relatively to some agreed datum.

,, m/s be the mass ejected per second at velocity v

,, M be the total mass of the composition such that $M/(m/s)$ is the time of flight.

,, F = the force of propulsion taken as constant.

Then, $F = v\ (m/s)$, and FV = work done per second usefully in propulsion.

$$= v\ (m/s) \times V \quad .. \quad .. \quad .. \quad (1)$$

and since time of flight $= M/(m/s)$, the total work done in propulsion

$$= v\ (m/s) \times \frac{MV}{(m/s)} = MVv \quad .. \quad .. \quad (2)$$

Now the total work represented by the total charge, mass M, ejected at velocity v

$$= \frac{Mv^2}{2} \quad .. \quad .. \quad .. \quad .. \quad (3)$$

$$\therefore \text{Efficiency} = MVv \div \frac{Mv^2}{2} = \frac{2V}{v} \quad .. \quad .. \quad .. \quad (4)$$

This is a most important result as relating to the exhaust efflux problem. The particular case when $v = V$ is of especial interest, that is when the efflux gas is left stationary in relation to the surrounding air, that being taken as datum. Under this condition the efficiency = 2, in other words 200 per cent.; a most remarkable and paradoxical conclusion: on the face of it absurd.

Special Case

Dealing with this as a special case the same result is reached. The condition is $v = V$. Thus $F = (m/s)v$ and the work usefully performed per second $= V(m/s)v = (m/s)v^2$. On the other hand, the work done by the charge per second in energy imparted to the efflux gas is $\frac{(m/s)v^2}{2}$, hence, Efficiency $= \frac{2\ (m/s)v^2}{(m/s)v^2} = 2$, or 200%.

The writer recently gave this result in a patent specification, and it was challenged by the examiner, who stated it to be impossible; the objection, however, was withdrawn when the writer presented the argument in the following form:

In the first place the meaning of the term *efficiency* in relation to propulsion had to be defined, as for example in its application to the screw propeller, or other normal implement of propulsion. In the case of an aeroplane it is understood that the work usefully performed is that which would be necessary if the aeroplane were propelled by a force acting from a fixed abutment, as for example if it were towed by aid of a perfectly flexible cord by means of a frictionless winding engine situated on a high tower. It is necessary to add that there shall be no wind or air current, for the supposed tower must be considered as fixed *relatively to the air*, a condition otherwise difficult to define, but no difference of principle is involved. If W_1 be the work done on this basis, and W_2 be that actually expended in operating the screw or other propulsion mechanism, the *efficiency* is defined as W_1/W_2. For example, if the two-rope h.p. = 100 and the actual h.p. = 140 the efficiency is 100/140 = 0.7 or 70 per cent. approximately. Thus expressed the efficiency cannot exceed 100 per cent.

Aircraft and Projectile

Now consider the case of an aeroplane or glider propelled by a force F (= drag), acting between it and a projectile travelling in the same direction and with the same velocity = V, we might consider this as being a howitzer shell at the top of its trajectory. Then when the force F is first brought to bear, the useful work in propulsion done per second will be $F \times V$. But during the first instant of its application, the force F will not be called on to spend energy or perform work at all because the projectile and the aeroplane are travelling in the same direction with the same velocity; instantaneously therefore the efficiency is *infinite*. As the projectile is retarded by the force* = F the work done becomes greater and greater in the direct proportion that the difference of velocity is increased, but the power usefully expended remains constant, for F and V are both constant. Then, when the projectile has been brought to a state of rest relatively to the surrounding air, it may, at that instant, be taken as equivalent to the fixed tower and by definition the efficiency is 100 per cent.

Now we are clearly entitled to regard the projectile as having originated as part of the aeroplane, and for this phase, during which the efficiency varies from infinity to 100 per cent., the previous analysis gives the integration or mean value as 200 per cent., which is not so extraordinary after all. The same applies if a continuous stream of particles, amounting to the same mass per second, be substituted for the single projectile. There need, therefore, no longer remain any doubt as to the validity of the result given, namely,

For rocket propulsion $\text{Efficiency} = \frac{2V}{v}$

(*To be continued next week*)

* Algebraically with minus sign.

Science and Industry

THE Department of Scientific and Industrial Research makes the following announcement:—Under the Order in Council dated 6th February, 1928, the Lord President of the Council has appointed Sir Joseph Barcroft, C.B.E., M.D., D.Sc., Sc.D., F.R.S., Sir Harold B. Hartley, C.B.E., M.C., D.Sc., F.R.S., and Sir Frank E. Smith, G.B.E., K.C.B., D.Sc., LL.D., F.R.S., to be members of the Advisory Council to the Committee of the Privy Council for Scientific and Industrial Research.

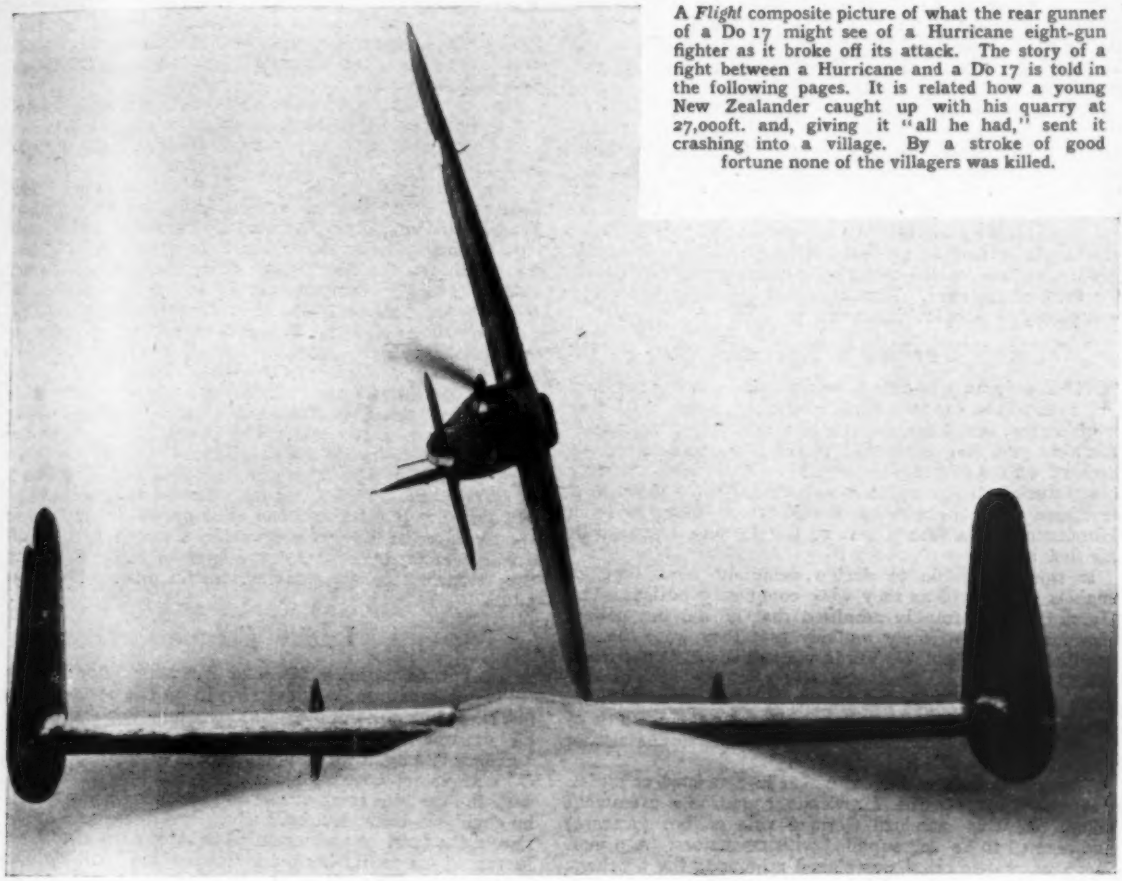
The Rt. Hon. Lord Cadman of Silverdale, G.S.M.G., D.Sc., LL.D., and Sir James Jeans, O.M., D.Sc., LL.D., F.R.S., have now retired from the Council on completion of their terms of office.

Dunlops in Whitehall

THE Dunlop Rubber Co. have lent the services of their Controller of Finance, Mr. F. R. M. de Paula, O.B.E., to the War Office as Deputy Director-General of Progress and Statistics.

This post is no new departure for Mr. de Paula as, during the 1914-18 war, he carried out similar work at the Ministry of Munitions under Sir George Beharrell, who is now chairman of Dunlops. When Sir George went to France as Assistant Director-General of Transportation, Mr. de Paula succeeded him in control of the department at the Ministry of Munitions. Later, after a period as assistant to Sir George in France, he, with the rank of Lieut.-Colonel, became the Assistant Director-General of Transportation in France.

WAR IN THE AIR



A *Flight* composite picture of what the rear gunner of a Do 17 might see of a Hurricane eight-gun fighter as it broke off its attack. The story of a fight between a Hurricane and a Do 17 is told in the following pages. It is related how a young New Zealander caught up with his quarry at 27,000ft. and, giving it "all he had," sent it crashing into a village. By a stroke of good fortune none of the villagers was killed.

HURRICANE v. DORNIER

Eyewitness Impressions of the R.A.F. in the Field—Part I

By H. F. KING

I HAVE had four crowded and lucky days in France. They were crowded because I took full advantage of the R.A.F.'s willingness to help, and lucky because I chanced to meet the right people or to be at the right place at the right time.

Chaperoned by R.A.F. conducting officers I visited a Battle squadron, a Hurricane squadron, a French aerodrome with Curtisses, Moranes, and Potez, an R.A.F. storage depot and a live-bombing range. But the worth of the trip cannot be reckoned entirely in terms of units visited. Equally enlightening were the conversations with pilots who had either been over the lines or had engaged enemy aircraft.

First let it be said that the R.A.F. is at the very top of its form. The most prevalent grouse was that our Hurricanes had had little opportunity of getting to grips with Me109s and Do17s, though the more frequent appearance of these aircraft and other German types was giving the fighter boys some satisfaction when I left.

Although Hurricanes and Messerschmitts have not yet been in the ring together, a few reconnoitring Do17s have had a taste of eight Brownings.

On a spring-like morning I started out for a Hurricane squadron not many miles behind the lines. Hooting aggressively our V-8 sailed past convoys of astonishing length. Three French Curtisses took off like surprised partridges as we approached their aerodrome. I gathered that they were off for a friendly sparring bout with a flight of our Battles which weaved 10,000ft. above us. A few miles ahead towards the lines was a column of smoke which puzzled us momentarily, but was soon forgotten.

No sooner had we stretched our legs outside the Hurricane squadron's H.Q. (a one-time school for young ladies) when we were told that a Hurricane had that morning brought down a Do17 reconnaissance machine which had crashed a few kilometres away. This was tremendous news and immediately explained the smoke. As the Dornier had dived vertically from well over 20,000ft., we felt that it would take some time to collect and remove the wreckage, and so spared ourselves five minutes to look at the victorious Hurricane which squatted like any ordinary Hurricane at the far side of the aerodrome.

Not only did we find it a very ordinary Hurricane, but, as Hurricanes go these days, a trifle démodé, having a fixed-pitch wooden airscrew and the original type of exhaust manifold. The armourers had the gun covers off and were

WAR IN THE AIR (Eyewitness Impressions Continued)

cleaning the Brownings with obvious pride. Other aircraftmen attended to a small piece of fabric which had loosened during the pull-out from the terrific dive after the crashing Dornier. After that the eight gun ports would be covered again to give a little extra speed before the guns were fired in the next action.

A kilometre or so from the crash we left the car and set off between the poplars down the road to a tiny village. By this time there was a regular pilgrimage of *poilus*, French Air Force personnel and peasants. We debated on the details of the Dornier, its engines, armament and equipment.

Rounding the bend into the village street I saw a blackened smoking trench in which two fires still burned, marking the engines, which must have been several feet below the level of the road. The scene was appalling, but there was plenty of technical interest.

Wreckage Spread

THAT only two of the villagers had been injured and none killed was incredible. Wreckage was spread over a wide area, and I found parts of the fuselage, wing, tail, machine gun magazines and pieces of equipment in an orchard and a churchyard nearby. A V.D.M. airscrew blade stuck in the ground like a spade suggested that it was feathered when the machine struck, which tallies with the Hurricane pilot's theory that he hit the port engine with his first burst.

It was impossible to decide definitely what type of engines were fitted as they were completely buried. The Hurricane pilot frankly admitted that he did not notice. However it is extremely unlikely that they were the old unsupercharged B.M.W. VIs in view of the fact that when intercepted the machine was still climbing at 27,000ft. More likely they were Daimler-Benz DB 600s or B.M.W. 132Dc or Bramo Fafnir radials, though the possibility of two-speed-supercharged direct-injection DB 601As cannot entirely be discounted.

The machine guns, one of which in a twisted condition was examined by the Hurricane squadron's armament officer, were of standard German rifle calibre (7.7mm.) and seemed to be well supplied with magazines. A 9 mm. Luger automatic pistol was picked up among the wreckage and was shown to me by the Hurricane pilot.

A label which may have come off an oleo leg read *Flugzeugwerke Halle GmBH, Halle / Saale. Lizenzbau* (built under licence from) *Dornier. Muster* (type) *Do 17. Sach Nr.* (part number) 172018-01. *Masch. Werke Nr.* (works machine number) 9 S30 C. The latter figures were given in the form of hieroglyphics. Another label referred to the machine as a Do 17P and indicated that it was built in March last year.

Magnesium-alloy castings seemed to have been used extensively, and from what one could gather the structure was similar to that shown in the *Flight* drawing published on November 2.

The Hurricane pilot showed me a salvaged oxygen bottle marked *Fuhrer*. This, of course, did not necessarily mean that the machine was leading a formation, as in the *Luftwaffe* a *Fuhrer* is a pilot.

A curious point was that the Dornier seems to have been coloured a sort of pastel blue, probably to render detection more difficult, though it must be remembered that, whatever the colour of an aircraft, it appears from a distance as a dark silhouette.

Another object found was an automatic device for selecting and firing combinations of coloured signal lights.

A shoulder strap belonging to an *Oberfeldwebel*, a high-ranking N.C.O., was of inferior material.

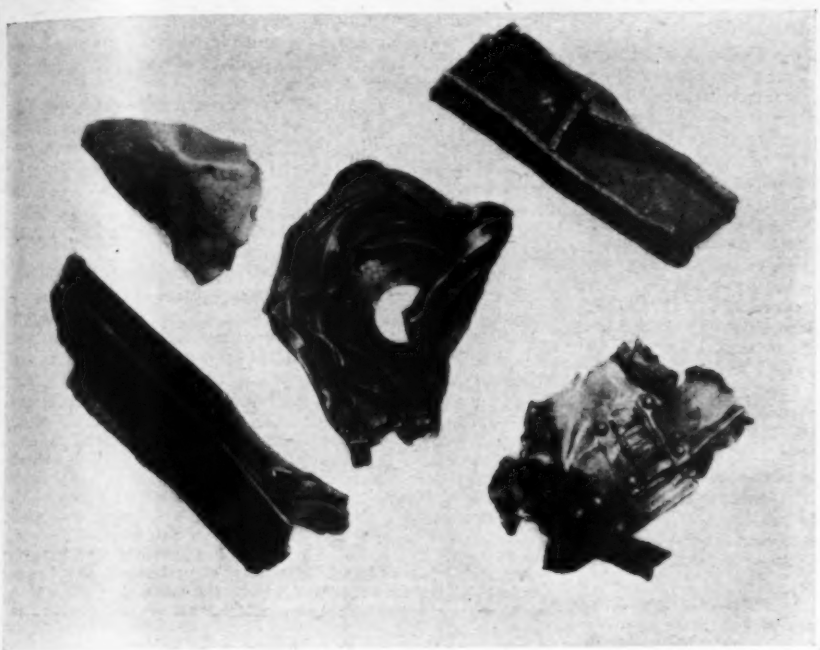
The Hurricane pilot, a twenty-one-year-old New Zealander, said that he caught the Dornier at about 27,000ft., having been attracted by bursts of anti-aircraft fire. The Dornier appeared still to be climbing, but it was no match for the Hurricane, which first attacked from below. The pilot saw white smoke or petrol vapour steaming from the port engine nacelle. Then the Dornier started evasive tactics and the top gunner was firing tracer; it seems uncertain whether there was a gunner in the bottom of the fuselage. The Hurricane lost height after its first attack, but immediately climbed and, opening fire again from a close range, prevented the Dornier taking cover in a single large cloud some distance below. After the Hurricane pilot had given the Dornier "all he had" the enemy machine went into a steep spiral and then into a headlong dive. The Hurricane followed it down, attaining over 400 m.p.h., and the pilot pulled out in time to see the Dornier hit, whereupon he returned to his aerodrome. Here, incidentally, the issue of *Flight* describing the Dornier bombers was in demand among his fellow pilots.

Lucky Escape

THAT same morning a second Hurricane pilot from the same squadron, while closing in on one of the four or five Do 17s which came over, was unfortunate enough to have his airscrew and reduction gear removed by a shell from a French A.A. gun which had already engaged the Dornier. Oil completely covered his windscreen, but while diving with the machine more or less out of control he found that he could see through a hole which had been made in the side of the fuselage and managed to set the machine down. It turned on to its back and caught fire, but the pilot managed to force off the cockpit enclosure and escaped with nothing more than an oil bath and a cut finger.

The largest piece of the Do 17 found after it had dived vertically from over 20,000ft. was this section of the tail.

WAR IN THE AIR (Eyewitness Impressions Continued)



"Flight" photograph.

A few pieces of the Do 17 which was shot down by a Hurricane. In the centre is the end of a machine-gun magazine. There are two pieces of the stressed-skin covering, a section of the extruded spar (top right) and part of a crank.

It was quite a morning for that Hurricane squadron.

While on the Hurricanes' aerodrome I noticed that the old red, white and blue stripes had been painted on their tails and that their fuselages bore the concentric tri-colour rings. These markings can, of course, be covered when the machines are on the ground.

The aerodrome was no Cranwell either in size or surface, but it did not bother the Hurricane pilots unduly.

The Hurricane is the best of all the Allied fighters now operating in France. It is faster and rather more manœuvrable than the French Curtiss, although the latter is extremely popular. The Curtiss, in turn, is more manœuvrable than the Morane 406, but none of the monoplanes in France can, of course, be thrown about like the slower Gloster Gladiators, a number of which are in use out there.

Combat to Come

AS yet the Hurricanes have not been matched against the Messerschmitts. When they are the combats will be well worth watching, for the Me 109 is certainly not the inferior machine which certain reports would suggest. With the Daimler-Benz DB 600 engine, the performance probably approximates to that of the Hurricane, though, if anything, it is somewhat lower. The DB 601 should make it superior to the Hurricane in flat-out speed.

There is no evidence that shell-guns have yet been used by Messerschmitts on the Western Front. The most common armament, in fact, seems to be four machine guns with considerably more ammunition per gun than is normally carried by Allied fighters, though the Hurricane, of course, has twice the number of guns.

There have been stories that the Messerschmitts are difficult to operate at night, though navigation lights are certainly fitted. The Hurricane, of course, takes night-flying in its stride.

Although there are several marked differentiating features, the Hurricane and Me 109 may, under certain conditions, and from a distance, be confused, as witness the story of the Hurricane pilot, who, after losing a Do 17 over Germany, turned for home. On his way he saw nine monoplane fighters above him and, thinking them to be his own squadron, closed up to join them. The Messerschmitts saw him and prepared to attack. So engrossed were they in the lone Hurricane that they were completely ignorant of the approach of a French Curtiss squadron which lost no time in taking a hand in the proceedings to the marked detriment of the Messerschmitts.

I have heard this story connected with the action in which nine, fourteen, twelve, or four Messerschmitts were destroyed. But I have given up trying to get the facts of that.

The Lull

THE lull on the Army front continues more or less absolute, and speculation is rife not only in this country but all over the world as to what the next move is going to be. As Mr. Chamberlain said in a speech read on his behalf by Sir John Simon at the luncheon in the Mansion House on the occasion of the installation of a new Lord Mayor of London, "I should like to make a few observations upon this strangest of wars which, in the form in which it has hitherto been waged, must seem to many who remember the 1914-1918 conflict, to be no war at all, but rather a state of siege. We do not know how long this phase will last or whether, at any moment, it will not be changed into violent conflict, but we can see at any rate that the position of the Allies has, as the weeks have gone by, rather strengthened than deteriorated."

The British fighter squadrons in France have as yet had no chance to equal the magnificent exploit of the French fighters when the latter engaged and routed with heavy losses a formation of 27 Germans.

On Monday, Nov. 6, and Tuesday, Nov. 7, a number of Royal Air Force aircraft carried out yet further reconnaissances over north-west Germany, on which useful photographs were taken. On each of these occasions one of our machines did not return to its base.

It is reported from Brussels that a pilot named Richard Frewen Martin landed in Luxembourg on Wednesday, November 8, under the impression that he was in France.

Some further details of the fine French victory of nine fighters over twenty-seven have now been published in Paris. One unofficial account says that all the French machines were of the Curtiss type, and another account states that all the German machines were Messerschmitts. The French paper *Intransigeant* says that the 27 Germans were making a demonstration of strength over the French lines. Apparently they intended to impress the French troops by flying in compact formation, imitating the methods of the German aircraft in Poland. Flying at 300 m.p.h. they had hardly reached French territory when the French squadron received the order to attack them. (Another correspondent says that the French fighters were escorting some reconnaissance machines when, at about 3 p.m., they observed three German fighter patrols of nine machines each.) The nine fighters immediately prepared to attack. The French anti-aircraft guns were already firing on the Germans

WAR IN THE AIR (CONTINUED)

Battle Over the Saar

IT was revealed later that the main battle was followed by other combats between the French and German aircraft. Two of the French machines which had previously been engaged flew along the Saar river and met seven or nine more Messerschmitts. They attacked and a battle raged over the hilly district west of Sarrelouis. The Germans turned tail and were pursued as far as the small town of Merzig, about 23 miles from Forbach. On another part of the front four French fighters engaged nine other Messerschmitts, and again the Germans were put to flight. All the French machines returned home safely, although four of them had been hit by bullets. Three German pilots were taken prisoner, one of them wounded. It is not certain whether these three belonged to the first battle or to one of the subsequent combats.

Once again some light forces of the Fleet, which on this occasion included two Polish destroyers, were attacked by German aircraft in the North Sea on Wednesday, November 8. This was something like the tenth attack by enemy aircraft on moving ships of our Fleet. This attack was no more successful than any of the previous ones, and no damage was done to any ship. The Admiralty statement remarked, "Enemy casualties are not known." This, of course, implies that the anti-aircraft guns on the ships had opened fire and that there was at least a possibility that some of the shells had scored hits.

The Coastal Command is playing its full part in all these over-sea activities, though naturally the majority of its flights do not produce sensational results. However, on the same day (Wednesday, November 8) two of our Coastal Command reconnaissance machines had the satisfaction of engaging in air combat with Germans. In one case a British pilot reported by wireless that he had made contact with the enemy, and a minute later he signalled "I have destroyed one enemy seaplane." Three hours later, after completing his patrol, he made a fuller report: "The fight took place at a height of approximately 100ft. (due to low clouds). I was carrying out my patrol when the enemy came out of the clouds above and behind me. He endeavoured to get on to my tail. I then did a steep turn until finally the enemy aircraft appeared in my sights. My air gunner and I both got in bursts at close range. The enemy seaplane then dived into the sea and sank, leaving only two floats and a parachute on the surface." The seaplane which was destroyed was a Heinkel.

Flying Boats Engaged

ANOTHER machine of the Coastal Command was in action against two German flying boats in succession, and the pilot only broke off the combat when his ammunition had all been expended. The first German flying boat was flying at about 100ft. when sighted. Five times the British pilot dived to the attack, climbing and attacking again. Several bursts were seen to enter the engines and the after part of the enemy's fuselage. "After the second dive attack," stated the pilot, "the German rear gunner's cockpit, which had been previously occupied, was seen to be empty. After the fifth dive the enemy aircraft was seen going down partly out of control."

While this fight was in progress the rear gunner had seen a second German flying boat coming up behind. He signalled to the pilot, but as it was still 1,000 yards away the pilot ignored it until he had disposed of his first opponent. As the first German aircraft went down he went to meet the second. He made two attacks and saw bullet holes appear in the nose of the enemy flying boat. These bursts silenced the enemy's front guns. "By this time, however, I had used all my front gun ammunition," said the pilot, "so I made three fairly tight circuits to give my rear gunner a shot." The gunner's aim was also accurate and a number of his bursts struck the engines and wings of the flying boat. By that time the British aircraft had made seven consecutive attacks on the two enemy flying boats and its ammunition was exhausted. The pilot therefore had no option but to turn off home. On the way back he sent a message giving the position of the enemy aircraft which he had seen go down.

On Saturday, November 11, two aircraft of the Coastal Command attacked a Dornier flying boat over the North Sea off the East Coast of England and forced the enemy aircraft down on to the water. The crew got into the collapsible dinghy carried on their machine and the flying boat then seemed to sink. A second enemy aircraft then appeared on the scene and was promptly attacked, but it managed to escape into the clouds.

The massing of German troops opposite the Dutch frontier has continued to cause grave anxiety. King Leopold of Belgium paid a surprise visit to Queen Wilhelmina of the Netherlands late at night, and subsequently an offer of mediation was made by the two Sovereigns jointly. On this Mr. Chamberlain commented in his speech which was read at the Guildhall banquet:—

"No doubt you have all read the communication which has been addressed by Their Majesties the Queen of Holland and the King of the Belgians to His Majesty the King as well as to the President of the French Republic and to the German Chancellor. Everyone will appreciate the lofty motives which have actuated the two Sovereigns in thus offering their good offices in the hope of avoiding a further extension of the war. I confess that I am not very hopeful of a satisfactory response from the German Chancellor in view of past experience. Nevertheless, we do not want to continue the war a day longer than is necessary if a satisfactory settlement can be obtained in another way."

Fighter Escorts

WELL-INFORMED opinion in London expected a German invasion of Holland, and the Dutch had already begun to take precautions and to call up reservists to their Army. The reason attributed to this anticipated German move is a desire for bases for submarines and aircraft on the Dutch coast. At the same time the possibility of the invasion of Belgium cannot be excluded. The German Government's spokesmen have for some time past been threatening a mass attack by air on Great Britain. It would seem that they have been much impressed by the successes of our fighters whenever they have had a chance of engaging German bombers, and naturally the Germans have been considering the question of sending fighter escorts for their bomber machines. Rotterdam is only some 185 miles from the London area, and therefore we cannot rule out the possibility that Messerschmitt and Heinkel fighters might be able to escort bombing formations from Rotterdam to London and back. They would not have much fuel reserve after having been engaged in combat with British fighters. If Belgium were also occupied by the Germans the distance from Nieuport to London is only about 115 miles, but even so, if the German fighters had to engage in a prolonged combat, their reserve of fuel would be perilously small. If long-range fighters were used by the Germans, they would, of course, be inferior in performance to the British Spitfires and Hurricanes. An escort of German fighters might delay the British fighters who first encountered the raid, and presumably it would be hoped that the German bombers would get away while a fight was in progress. However, that would not follow at all, for the British strength in fighter aircraft is sufficient to tackle not only the escort, but also a convoy of bombers.

On Wednesday, November 8, a bomb exploded in the Beer Cellar at Munich only a few minutes after Herr Hitler and other Chiefs of the Nazi Party had left. It did great damage and caused a number of casualties. As might have been expected, the Nazi Party has attributed this to the work of British Secret Service agents; naturally ignoring the fact that that is not the way in which the British people deals with its enemies. The incident, however, will doubtless serve as useful propaganda in Germany and may be used to excuse any brutalities which the *Luftwaffe* may attempt to commit against Britain.

SERVICE AVIATION

Royal Air Force and Official Announcements

SEA PATROL: A Saunders-Roe Lerwick flying boat (two Bristol Hercules) over a familiar coastal land mark.

Casualties

IN the ninth casualty communiqué, the Air Ministry regrets to announce the following casualties on various dates:—

KILLED IN ACTION.—A/C.2 J. D. Whitford, Cpl. R. A. Wilson.

KILLED ON ACTIVE SERVICE.—P/O. C. C. Cameron, A/C.2 L. G. Dicks, Cpl. B. F. Evans, A/C.1 E. Grant, Cpl. O. H. J. Jordan, A.P/O. I. A. Peeler, F/O. E. N. Prescott, P/O. G. A. C. Rhind, F/O. P. E. Torkington-Leech.

MISSING.—Sgt. G. J. Burrell, Sgt. G. W. Marwood, P/O. A. G. Salmon, A/C.1 R. B. Smith, P/O. P. E. W. Walker.

DIED ON ACTIVE SERVICE.—Flt. Lt. R. C. S. Allin, Cpl. J. Carbery, A/C.1 F. W. Corrin, A/C.2 M. G. French, A/C.2 W. Hartley, A/C.2 W. C. Hilsdon, L.A/C. A. C. Hyland, Flt. Lt. R. C. Lewis.

PREVIOUSLY REPORTED "MISSING, BELIEVED KILLED," NOW REPORTED "KILLED IN ACTION."—F/O. D. Ford, A/C.2 J. H. Hayward.

PREVIOUSLY REPORTED "MISSING," NOW REPORTED "MISSING, BELIEVED KILLED IN ACTION."—A/C.2 R. V. Britton, Acting Sgt. W. Brown, Sgt. J. Pearce, A/C.1 A. Thomason.

PREVIOUSLY REPORTED "MISSING," NOW REPORTED "PRISONER OF WAR."—F/O. R. D. Baughan, Wing Cdr. H. M. A. Day, F/O. A. C. MacLachlan, Sgt. G. J. Springett.

Awards

THE following rewards in recognition of gallant and distinguished services rendered in connection with the operations in Waziristan, during the period December 16, 1937, to December 31, 1938, are additional to those published in *Flight* on November 2:—

B.E.O. Medal (Mil.) for Meritorious Service

Sgt. John Gordon Byrne Burns.

Mentioned in Despatches

Sqn. Ldr. C. Stephenson, Flt. Lt. E. K. Piercy, Flt. Lt. F. L. Newall, F/O. F. R. Foster, F/O. P. N. Jennings, F/O. F. F. Lambert, Flt. Sgt. W. T. C. Morman, Flt. Sgt. W. Panton, Flt. Sgt. W. C. J. Starling, Sgt. W. R. Fraser, Cpl. D. H. Davis, A.F.M., Cpl. L. Spinks, Hawai Sepoy, 1st Class, Kartar Singh (Indian Air Force).

Drill Modifications

THE introduction of movements in three ranks has been announced by the Air Ministry and will be applied immediately by training units at home, and as soon as practicable by other units at home and abroad.

Telling the Weather

THE rapid extension of the work of the Meteorological Office is shown by the Director's report for the year ended March 31, 1939. The number of stations attached to the R.A.F. was, for example, increased from thirty-one to sixty-eight.

Use of Clubs

THE committees of the three following London clubs have offered to elect, as honorary members for the duration of hostilities, all officers of His Majesty's Forces: Queen's Club, West Kensington, W.14; Roehampton Club, Roehampton Lane, S.W.15; and Lansdowne Club, Berkeley Square, W.1.

Empire Co-operation

REPRESENTATIVES for Great Britain, Australia, and New Zealand took part in a conference at Ottawa last week to discuss the Empire air training scheme. Their problems are considerably lessened by the repeal of the United States arms embargo, and Canada is said to be preparing to purchase a large supply of aircraft from the U.S.A.

A technical training centre, with workshop accommodation and housing for 3,000 men, has already been obtained in Canada. The centre is a conversion of the buildings and grounds of a new hospital at St. Thomas, Ontario, which was put at the disposal of the Royal Canadian Air Force by the Ontario Government.

South Africa is preparing her own scheme, and special training schools are being established by arrangement with the British Government. Training of pilots, observers, photographers, and machine-gunners is to be carried out on a large scale, and, according to semi-official messages from Pretoria, home of the South African Military College, there is no lack of volunteers for the defence forces.

Air Gunners

APPLICATIONS are invited for appointment to commissions, for the duration of the war, in the General Duties Branch of the R.A.F.V.R. for duty as air-gunners. Applicants must be between 28 and 35 years, have received a good education, and be used to handling men. The duties require first-rate physique, high courage and determination, and powers of endurance. Men accustomed to open-air sports (particularly shooting) are specially eligible, and a knowledge of machine-guns and experience of flying is an advantage, but not essential. Members of the Civil Air Guard are eligible.

Appointments will be in the initial rank of acting pilot officer. Forms of application may be obtained from the Air Ministry (S.7e.(5)), Adastral House, Kingsway, London, W.C.2.

The Distinguished Flying Cross

MR. GRANT-FERRIS asked the Secretary of State for Air whether airmen and non-commissioned officer pilots were eligible for the award of the Distinguished Flying Cross.

Sir Kingsley Wood replied that non-commissioned officer pilots and airmen were under the terms of the Royal Warrant eligible to be considered for the Distinguished Flying Medal.

Mr. Grant-Ferris then asked: Would it not be an excellent thing if all pilots were eligible for the higher award?

Sir Kingsley Wood replied that there were certain distinctions, but it would be appreciated that there was a certain difference in the responsibility of these men.

In reply to a further question, Sir Kingsley Wood promised to look into the matter.

Volunteer Reserve in India

THE provisions of the Indian Air Force Volunteer Reserve (Discipline) Ordnance came into force from September 16. The personnel of the Reserve is to be drawn from the civilian population

Service Aviation

AT THE AIR MINISTRY: Air Vice-Marshal R. E. C. Peirse, deputy chief of the Air Staff and a new member of the Air Council, as announced last week.

in the same way as Volunteer Reserves in other parts of the Empire. It is learned that, although no census of civil pilots is to be taken, the Government of India are now in touch with flying clubs in various parts of India which are in a position to supply suitable men for training.

Steps have already been taken to form Volunteer Air Force Reserves in Hong-Kong and Malaya, and two British Air Ministry officials lately arrived in Colombo with the object of creating a Ceylon Air Force Reserve in conjunction with the Colombo Flying Club.

Commissions for Airmen

AN Air Ministry order, pending a fuller one, lays it down that all commissions granted to airmen during the war will be "for duration" only. Commissions granted to regular airmen will be in the Royal Air Force, and to others in R.A.F. Volunteer Reserve. On appointment to commissioned rank airmen will be discharged from their existing engagements. An assurance is given that airmen commissioned in the regular R.A.F. will be considered for permanent commissions after the war, and if not selected will be given the choice of retiring with gratuity or retired pay or of re-enlisting as airmen with appropriate rank and seniority and serving to complete the balance of the period for which they would have been eligible to serve if they had not been granted commissions.

At present airmen pilots may be selected as Pilot Officers in the General Duties Branch, and Warrant Officers may become Flying Officers in specialist branches.

Royal Air Force Gazette

Air Ministry, November 7.

General Duties Branch.

The following are granted short service commissions as Acting Pilot Officers on probation for four years on the active list (Oct. 23):—R. A. C. Aeberhardt, H. R. Allen, D. R. Allen, D. M. M. Bell, S. C. R. Bell, D. F. Benbow, W. G. Bennett, A. E. Bigelow, G. C. H. Birchall, C. A. W. Bodie, C. R. Bonseigneur, P. Brandon Trye, P. Bray, B. T. Brigg, R. R. Briscoe, E. Burgoyne, T. M. Calderwood, D. L. Clarke, J. C. R. Clarke, E. J. Coleman, W. P. Collins, J. K. M. Cooke, P. G. Cooper, M. A. Coote, J. T. Crossey, W. A. Cuddie, R. S. Currie, D. S. Dadson, W. C. Dallin, J. Dean, R. P. A. J. de Burlet, J. Dellow, F. G. de Sieves, C. E. Dewar, R. B. Deway, W. H. Dimmock, D. Y. Douglas, W. H. Downs, R. R. Drew, C. T. Dutton, R. D. Treble, C. O. Dunkels, R. C. Ensign, M. A. Esplen, A. J. Farie, J. J. Finlay, B. Firminger, A. W. Fletcher, W. M. W. Fowler, P. J. Frisby, C. G. Frizell, R. S. Gaskell, H. T. Gilbert, R. F. Harman, G. J. M. Hart, D. K. Hayes, A. Hindley, R. E. M. Hughes-Chamberlain, J. Hurry, A. K. Jackson, P. G. V. Jarvis, G. B. W. Jobling, A. L. Jones, J. J. P. Kenny, M. A. King, G. R. Lambert, H. W. E. Lane, J. G. Langford, J. E. P. Laricheliere, J. H. Leland, E. J. Lester, W. S. Longhurst, R. M. McT. D. Lucas, A. G. McAfee, G. McKenzie, B. P. McNamara, T. S. H. Mainland, M. M. Mair, J. P. R. Manoy, D. M. March, R. F. S. Marriott, H. E. Martineau, R. G. D. Mathews, P. R. Mildren, J. G. Miller, R. A. E. Milton, T. G. Moore, P. Morcom, J. E. Morris, R. Mottram, M. H. Mounsdon, A. K. Ogilvie, F. J. Otterway, K. V. Palmer, D. A. J. Parfitt, B. Parnell, J. S. Pay, D. A. Payne, J. W. P. Perkins, D. E. F. Powell, E. F. Publicover, J. C. Pugh, R. M. Pugh, P. C. Pullen, J. W. Rae, E. O. Richards, J. A. Rose, P. Ross, P. W. Roylance, J. M. Rumsey, F. W. F. S. Russell, L. D. Sandes, C. H. Saunders, J. P. Seabourne, L. A. Sears, P. D. Short, N. D. Sinclair, I. A. Slaughter, D. A. Smith, G. M. R. Smith, J. D. Smith, R. W. Smith, J. Ll. Soden, E. N. Southwell, H. R. Stothard, W. R. N. Sturdy, M. F. Suckling, C. F. Sutcliffe, D. A. Taylor, P. A. W. Thomas, A. M. Todd, J. R. Topham, D. Q. W. Tracy, R. E. Troward, M. R. Turnbull, R. A. Ullman, A. A. Vanderwater, J. F. L. Walker, T. Y. Wallace, J. T. Wardlaw, A. B. Watkinson, D. P. Watson, J. S. Watters, K. G. Webb, G. H. A. Wellum, E. L. West, D. A. White, M. White, P. C. Wickings-Smith, J. S. Wigglesworth, W. C. Wigmore, P. Windram, R. A. R. M. Woodhouse, C. Wright, J. G. Yates.

The following ex-Flight Cadets are granted permanent commissions as Pilot Officers on probation on the dates stated:—A. F. Delamore, J. A. Harries, G. O'F. G. Hyne, I. N. MacDougall, R. A. L. Morant, K. W. Worsdell (Oct. 21); N. J. V. Benson, R. M. Hogg, R. H. Holland, P. A. G. Learmond, A. R. Wright, R. D. Yule (Oct. 23).

The following Pilot Officers on probation are confirmed in their appointments on the dates stated:—L. J. W. Felgate (Feb. 20); the Hon. R. A. G. Baird, J. G. Fletcher, R. H. Kewish, A. G. Wilson (July 10); A. W. Ellis, T. R. Turnbull, R. W. Wallens (Oct. 7); B. van Mentz (Oct. 19); J. M. Hogston (Oct. 30).

The following Acting Pilot Officers on probation are graded as Pilot Officers on probation and confirmed in their appointments on the dates stated:—A. G. Douglas, S. W. Griffiths, F. S. Richardson, K. B. Watkins (Oct. 6).

The following Acting Pilot Officers on probation are graded as Pilot Officers on probation on the dates stated:—A. R. Grevstad, C. P. De L. Hulton-Harrop, A. C. Manaton, G. P. Robertson, R. J. Bailey, P. P. C. Barthropp, A. J. Bradley, S. R. McNamara, G. J. Menzies (Sept. 3); H. J. Heal (Oct. 31).

The following Pilot Officers are promoted to the rank of Flying Officer on the dates stated:—W. O. V. Bennett, J. W. B. Wilkinson-Bell (seny. June 3, 1939) (March 3); F. J. Fenton, J. J. Lowe, D. G. Parnall, A. R. B. Tedder (seny. Dec. 3, 1939) (March 3); J. F. Fraser (seny. Dec. 6, 1938) (March 6); R. H. Smith (March 14); C. J. Mount (seny. June 26, 1938) (March 26).

Air Vice-Marshall R. E. C. Peirse, C.B., D.S.O., A.F.C., is granted the acting rank of Air Marshal on appointment as an additional member of the Air Council (Oct. 30).

Equipment Branch.

The following Pilot Officers on probation are confirmed in their appointments (Sept. 12):—N. B. Silk, T. I. Plant.

The following Pilot Officers on probation are confirmed in their appointments and promoted to the rank of F/O (Sept. 12):—J. O'Neill, C. S. W. Harte, P. J. Lutley, C. R. Burstall, A. Marr, M. Dean.

The short service commission of A.P/O. on probation D. C. Warren is terminated on cessation of duty (June 28); the notification in the *Gazette* of Oct. 31 concerning A.P/O. on probation G. M. D. Roberts is cancelled.

Medical Branch

The following Flight Lieutenants are granted permanent commissions in that rank (Sept. 7):—C. C. Barker, M.B., Ch.B.; J. R. Cellars, M.B., Ch.B.; D. J. Dawson, M.R.C.S., L.R.C.P.; G. B. MacGibbon, M.B., Ch.B.; D. F. B. Shaw, M.B., Ch.B.

Erratum

In the *Gazette* of Oct. 10, for D. W. Gayland read D. W. Garland.

Princess Mary's Royal Air Force Nursing Service

The following Staff Nurses are confirmed in their appointments on the dates stated:—Miss I. M. Chapman (Sept. 1); Miss D. E. Wood (Sept. 6); Miss E. Smyth (Sept. 8); Miss M. A. Boyd (Sept. 10); Miss I. M. L. Barnes (Sept. 15); Miss I. E. W. Lewer (Sept. 28); Miss E. B. Casey (Sept. 30); Miss F. H. Willcox (Sept. 31).

Sister Miss M. G. Bryant resigns her appointment (Nov. 1).

Royal Air Force Reserve

RESERVE OF AIR FORCE OFFICERS

General Duties Branch

P/O. J. D. Rose is promoted to the rank of F/O. (May 9); Flt. Lt. J. A. Willoughby is granted the rank of Sqn. Ldr. (July 31); F/O. Sir H. A. Colt, Bt., D.S.O., M.C., relinquishes his honorary commission in Class C on appointment to a commission in the Royal Air Force Volunteer Reserve (Sept 1.).

The following relinquish their commissions in class CC on appointment to commissions in the Royal Air Force Volunteer Reserve (Sept. 1):—Wing Cdr.—T. F. Bullen, O.B.E. (Sqn. Ldr., R.A.F., Ret.). Sqn. Ldrs.—F. T. McElwee (Flt. Lt., R.A.F., Ret.), E. W. Simpson, B. D. S. Tuke (Flt. Lt., R.A.F., Ret.). Flt. Lt. (Hon. Sqn. Ldr.).—C. E. H. C. Macpherson (Sqn. Ldr., R.A.F., Ret.). Flt. Lt. (Acting Sqn. Ldr.).—E. A. Sullock, A.F.C. Flt. Lts.—G. S. Smith, M.B.E., D. A. Macfie, A. V. Le Maistre, W. S. Newton-Clare, M.B.E., F. T. Eades, D.F.C. (Flt. Lt., R.A.F., Ret.), W. E. Crook, N. T. Goodwin, S. C. Harker, R. P. Smillie, H. E. Greenberry, H. B. Maund, H. Bligh, R. Stiven, C. N. Leeston-Smith, C. B. Seagrim, C. Baines. F/O. (Acting Flt. Lt.).—N. V. Lindemere. F/O.—H. W. Durtnell.

The following Flight Lieutenants relinquish their commissions on cessation of duty from the dates stated:—W. A. Lindsay-Watson (Sept. 1); L. G. Graham-Wigen (Oct. 1); C. E. W. Kennedy (Oct. 15).

Royal Air Force Volunteer Reserve

GENERAL DUTIES BRANCH

F. S. Cotton is granted a commission for the duration of hostilities as Sqn. Ldr. (Hon. Wing Cdr.) (Sept. 22).

The following are granted commissions for the duration of hostilities as Pilot Officers on probation on the dates stated:—E. H. F. Fuller (Oct. 22); A. B. Woods (Oct. 23); J. C. Nichols-Marcy (Oct. 25); J. G. McEwan, J. B. Thompson (Oct. 26).

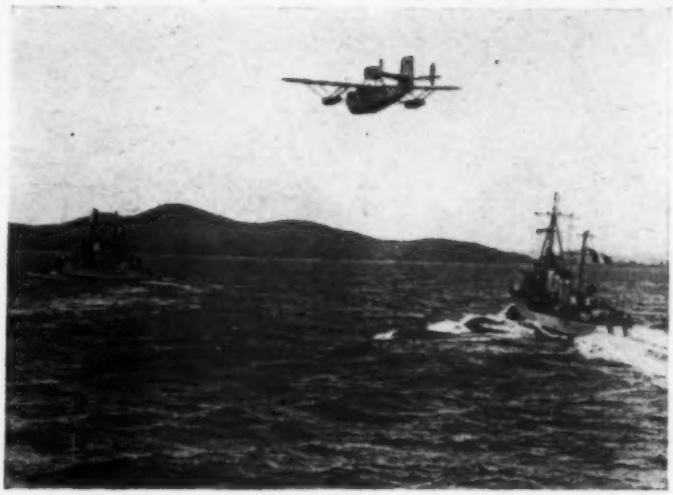
The following are granted commissions for the duration of hostilities as Acting Pilot Officers on probation (Oct. 23):—F. O. S. Dobell, C. M. Gasper.

Administrative and Special Duties Branch

Brig.-Gen. F. L. Festing is granted an honorary commission as Group Capt. (Sept. 7).

The following are granted commissions in the ranks stated with effect from Sept. 1 and with seniority of the dates stated:—Wing Cdr.—Sqn. Ldr. T. F. Bullen, O.B.E. (R.A.F., Ret.) (March 6). Sqn. Ldrs.—Sqn. Ldr. E. W. Simpson (R.A.F.O.) (March 9); Flt. Lt. B. D. S. Tuke) (R.A.F., Ret.) (May 11); Flt. Lt. F. T. McElwee (R.A.F., Ret.) (June 9); Flt. Lt. E. A. Sullock, A.F.C. (R.A.F.O.) (July 27). Flt. Lts.—Capt. R. Stiven (I.A. Regt.) (Sept. 6, 1936); Flt. Lt. H. Bligh (R.A.F.O.) (Jan. 4, 1937); Capt. H. B. Maund (July 13, 1937); H. E. Greenberry, R. P. Smillie (April 8); Flt. Lt. S. C. Harker (R.A.F.O.) (Aug. 30, 1938); Flt. Lt. N. T. Goodwin (R.A.F.O.) (Jan. 20); Sec. Lt. W. E. Crook (Feb. 13); Flt. Lt. F. T. Eades, D.F.C. (R.A.F., Ret.) (Feb. 16); Capt. D. A. Macfie, Capt. W. S. Newton-Clare, M.B.E. (June 12); Capt. A. V. Le Maistre (I.A., Ret.) (July 1); F/O. G. S. Smith, M.B.E. (July 24); Sqn. Ldr. C. E. H. C. Macpherson (R.A.F., Ret.) (Aug. 5); Capt. J. H. F. Newland (I.A., Ret.). Flt. Lt. T. J. West, F/O. R. G. Agnew, Flt. Lt. C. C. Edwards, Capt. C. B. Seagrim (I.A., Ret.), F/O. N. V. Lindemere (R.A.F.O.), Mrj. S. Fairfield, M.V.O., Lt. C. N. Leeston-Smith, Lt. R. A. Lidstone (R.N., Ret.), Lt. R. A. S. Howes, Capt. D. F. Fitzgibbon, Lt.-Cdr. Sir H. A. Colt, Bart., D.S.O., M.C. (R.N., Ret.), Maj. J. B. Smalley (I.A., Ret.), H. W. Durtnell, Lt. K. C. Leslie, P/O. E. F. Kohler, Capt. E. Travers-Smith (I.A., Ret.), Lt. R. V. Jameson, Sec. Lt. W. H. A. Monckton, M.M., F/O. F. E. North, Capt. C. Baines, Lt. G. M. Angier, Lt. D. C. Davies, Capt. F. H. Cooke (Sept. 1).

The following Pilot Officers on probation are confirmed in their appointments and promoted to the rank of F/O on the dates stated:—E. D. Drew (Aug. 14); W. F. Anning, V. C. S. Bach, H. A. Bartlett, G. E. R. Baxter, F. G. Carpenter, W. P. Hawgood, J. F. Higgins, E. D. Jennings, J. T. Knight (Aug. 31); A. Croft, O. R. Orchard (Hon. Sqn. Ldr.), C. Q. Steel,



THE FRENCH NAVAL AIR ARM: A Lioré reconnaissance flying-boat—the equivalent of our Supermarine Walrus—operating in the Mediterranean. This is a very sturdy though, of course, slow machine.

J. E. F. Voss (Hon. F/O.) (Sept. 1); E. R. Taylor (Sept 2); S. W. M. Bunting (Sept. 5); J. D. Rees (Sept. 6); W. E. N. Clark (Hon. Flt. Lt.), F. L. D. Davies (Hon. Wing Cdr.), E. J. Matthews (Hon. F/O.), F. C. W. Taylor (Hon. Sqn. Ldr.) (Sept. 7); J. M. Welshman (Sept. 10); E. P. L. Baker (Sept. 11); A. D. Loughborough (Oct. 11).

F/O. (Hon. Flt. Lt.) J. L. Jones is promoted to the rank of Lts. Lt. (Sept. 1); P/O. on pprobation J. A. Cunningham, D.S.O., D.F.C., resigns his commission (Aug. 3).

Equipment Branch.

The following are granted commissions as Flight Lieutenants, with effect from Sept. 1, and with seniority of the dates stated:—Sqn. Ldr. N. F. D. Buckeridge (R.A.F., Ret.) (Feb. 2, 1931); Capt. H. Sadler (I.A., Ret.) (June 20); F/O. H. J. Thomas, Capt. B. Lockner (Sept. 1).

Accountant Branch.

The following are granted commissions as Flight Lieutenants with effect from Sept. 1 and with seniority of the dates stated:—Maj. H. V. Bayliss (July 19, 1937); Maj. E. G. W. Robertson (I.A., Ret.) (Dec. 1, 1938); Maj. H. N. Baker (I.A., Ret.), Capt. E. M. D. Darell, O.B.E. (I.A., Ret.), Capt. J. D. Cameron, O.B.E., Payr.-Lt. W. J. Culham (R.N., Ret.), Cdr. R. G. H. Izat (R.N., Ret.), Lt. J. Aylward, Lt. W. H. Fiddler, M.B.E. (I.A., Ret.), Maj. E. Andrew, M.C., Maj. F. O. Mannion, Lt. F. W. Richings (R.N., Ret.), Capt. J. T. Keay, M.C., Maj. R. B. L. Harvey, Capt. D. McNaught (Sept. 1).

Medical Branch.

G. L. Keynes, M.D., F.R.C.S., is granted a commission for the duration of hostilities as Group Captain (Oct. 17); T. K. Lyle, M.D., M.Chir., M.R.C.P., F.R.C.S., is granted a commission for the duration of hostilities as Sqn. Ldr. (Oct. 12); E. G. Dermer, M.B., B.S., D.L.O., F.R.A.C.S., is granted a commission for the duration of hostilities as Flt. Lt. (Oct. 17).

The following are granted commissions for the duration of hostilities as Flying Officers on the dates stated:—D. M. Anderson, M.D., Ch.B., R. R. Foote, M.R.C.S., L.R.C.P., D.R.C.O.G., A. S. Lee, M.B., B.S., M.R.C.S., L.R.C.P., A. N. H. Peach, M.B., Ch.B., B. M. Phillips, M.R.C.S., L.R.C.P. (Oct. 12); J. G. Bate, M.B., Ch.B., J. R. Caldwell, M.R.C.S., L.R.C.P., K. V. Jackson, M.R.C.S., L.R.C.P., G. J. Marks, M.B., Ch. B. (Oct. 17).

Dental Branch.

The following are granted commissions for the duration of hostilities as Flying Officers on the dates stated:—J. Costello, B.D.S., T. M. Joyce, B.D.Sc., (Sept. 28); I. H. Fleming, L.D.S., J. T. Holford, L.D.S. (Oct. 2); F. W. H. Cowper, L.D.S. (Oct. 9); E. H. Thompson, L.D.S. (Oct. 16).

Auxiliary Air Force

General Duties Branch.

No. 615 (COUNTY OF SURREY) SQUADRON.—The following Acting Pilot Officers on probation are confirmed in their appointments and graded as P/Os on the dates stated:—K. T. Lofts (April 22); J. R. Lloyd (July 7).

No. 903 (COUNTY OF LONDON) SQUADRON.—Acting Pilot Officer on probation D. K. Etherington is confirmed in his appointment and graded as P/O. (July 28).

No. 919 (WEST LANCASHIRE) SQUADRON.—Flight Lieutenant E. J. Richmond is promoted to the rank of Sqn. Ldr. and appointed to the command of the Squadron (July 15).

The following are promoted to the rank of Flight Lieutenant on the dates stated:—F/O. W. M. S. Fox (Aug. 13); P/O. J. C. A. Reid (Aug. 18).

No. 920 (WEST LANCASHIRE) SQUADRON.—The following are promoted to the rank of Flight Lieutenant on the dates stated:—F/O. L. B. Ridley (Aug. 12); P/O. D. H. Nield (Aug. 16); P/O. H. S. Bailey (Aug. 17).

No. 921 (WEST LANCASHIRE) SQUADRON.—The following are promoted to the rank of Flight Lieutenant on the dates stated:—P/O. C. L. Lomas (Aug. 10); F/O. W. G. Redmond (Aug. 14); P/O. L. W. Shepherdson, M.C. (Aug. 15).

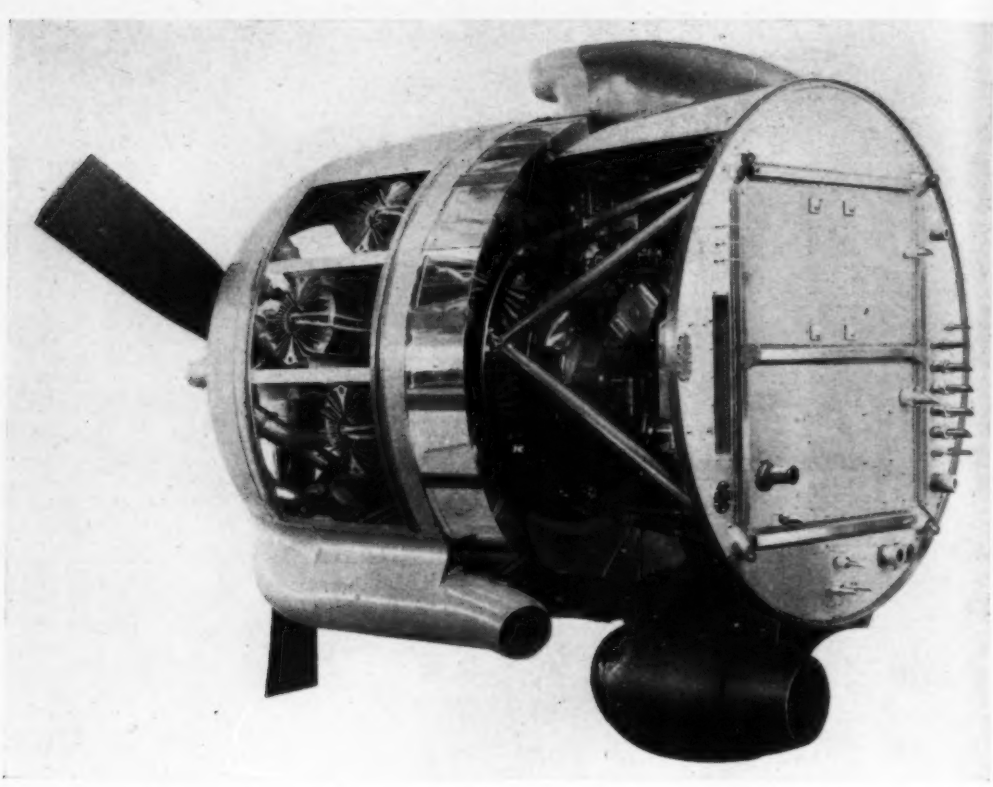
Equipment Branch.

No. 919 (WEST LANCASHIRE) SQUADRON.—A. Richards is granted a commission as Pilot Officer (Sept. 1).

Medical Branch.

No. 926 (EAST LANCASHIRE) SQUADRON.—G. B. Hardman, M.B., Ch.B., is granted a commission as Flying Officer (Sept. 1).

—AND THE AMERICAN: Vought and Curtiss dive-bombers of the U.S. Navy make a majestic spectacle as they fly past in mass formation over the Pacific. The formation also contains some Douglas monoplane torpedo bombers which correspond to our T.S.R. machines.



ONE SOLUTION : The "power egg" standardised unit for the Bristol Hercules engine.

INTERCHANGEABILITY

Some of the Problems Encountered When Planning a Standardisation of Aero Engine Units Examined

By J. A. T.

FOR some considerable time past there has been a great deal of talk concerning a scheme which, if it could be satisfactorily developed, would not only greatly simplify the installation of aero engines, but would also permit of an easy change from one engine to another. This scheme is intended chiefly for multi-engined aircraft. It aims at producing a complete installation which can be assembled as a unit and fitted to any particular class of aircraft, without it being necessary to modify the structure.

The idea of the scheme is good. In times of emergency one engine could be substituted for another in only a fraction of the time it takes at present. Further, it would make the engine manufacturer completely responsible for the power unit as a whole. The aircraft constructor would only have to connect this unit to his airframe. The result would be a reduction in drawing office expenses, simplified production and a speed-up of output. So far as the operator or the Royal Air Force are concerned, maintenance should be cheaper, and there would be fewer machines grounded for repairs to the engine.

There are many difficulties which must be overcome before the scheme can be made practicable. However, these snags have apparently been overcome in Germany and in the U.S.A., where similar schemes have been evolved, although there is very little information available regarding them. There is no reason why the scheme should not be a success in this country also.

A great deal of time and money has been spent on the idea here, but so far very little seems to have been achieved. It is to be hoped that engine and aircraft manufacturers will get down to the job in a spirit of co-operation, so that the industry may benefit from any improvements resulting from the scheme and from the collaboration of aircraft and engine designers.

The difficulties encountered in developing this scheme are of two kinds: aerodynamic and structural. When it is necessary to replace an engine by another of a different type, but of similar horse-power, questions arise regarding the effect on the flying qualities of the machine. There will invariably be a difference in the position of the thrust line ; this will, of course, affect airscrew ground clearance, as well as having its effect on flight in engine-on and engine-off conditions, or on rudder control, possibly both. Positions of the centre of gravity will also vary and may be serious enough to throw out the trim of the machine and necessitate structural alterations. Further, frontal area must be considered. The engine with the largest frontal area will decide the minimum size of the bulkhead. This means that with only one particular engine is a given machine most efficient. Other engines might be working in front of a bulkhead which is possibly a square foot larger than it need be. The advantage of an engine with a small frontal area would, therefore, be lost.

The scheme could, of course, be divided into two groups, which we might call A and B. Group A would apply to, say, four or five different engines of similar horse-power, but it would be immaterial whether they were radial or in-line engines. In this group the aerodynamic points mentioned would be most apparent. Group B would deal solely with engines of a similar type, e.g., with in-line

engines only. In this case there would be but slight differences in thrust line and C.G. positions, and certainly the engines would not be working under the disadvantage of the large bulkhead (frontal area) required by a radial engine. Considering the practical side, the difficulties would be similar for groups A and B, and it is only when consideration is given to the performance of the aircraft and its flying qualities that subdivision into groups has its advantages.

One of the first important questions to be decided is whether or not the fireproof bulkhead shall be included in the nacelle, to be removed complete with engine mounting when a change of engine is made. The question is not easy to decide, as the bulkhead often plays an important part not only as regards the engine but also the airframe. The present practice of carrying many of the engine auxiliaries on the bulkhead further complicates the matter. There are two possibilities: One, that the engine mounting shall be bolted up to fittings projecting through the bulkhead from the wing structure, the bulkhead being part of that structure; or two, that the mounting, complete with the bulkhead, shall be attached to the structure by fittings placed behind the bulkhead.

The Fireproof Bulkhead

I think it is correct to say that until now the fireproof bulkhead has always been considered as part of the airframe; most certainly it has always been the job of the aircraft firm to design and make it. The present tendency, however, is to regard it as part of the engine unit, to be decided upon in collaboration with aircraft firms, and supplied by the engine manufacturer. This at least is the policy adopted in the U.S.A., and it is probable that the scheme in this country will be similar in this respect.

Whether or not this step is wise can only be decided by reviewing the position. On a modern bulkhead there is very little waste space, and a great deal of time is spent arranging the engine controls, pipe lines, electrical connections, and the various ancillary apparatus which has to be fitted. Much of this, however, is only required on one particular engine, and the space which it occupies is invariably needed for another component or connection on a different engine. It is, therefore, difficult to visualise one bulkhead being suitable for more than one type of engine. This automatically suggests that the bulkhead should be removable with the engine.

Assuming this to be a basis upon which to work, one has still to decide the detail points. To warrant the term interchangeability the scheme must provide for the rapid coupling of all connections which, now that we have decided to remove the bulkhead, must be made behind it. Fuel and oil pipe lines which normally pass through the bulkhead should be connected up by double-ended flanged unions, so that connections to the engine would be permanently made between the engine and one end of the union mounted on the bulkhead. All electrical leads should be grouped into high-tension and low-tension units, and connections should be made through the bulkhead by suitable multiple plugs. Vacuum and hydraulic supply lines would be connected in the same way as fuel and oil lines.

Regarding the engine controls, there would need to be some standardisation of the length and angular movement of the various levers so that they could be permanently connected to a standard control box, definitely positioned on the bulkhead. The interconnection of throttle and mixture levers relative to the supercharger should also be made either on the engine or by the coupling to the control box. So far as the engine mounting is concerned, the pick-up points for this would have to be limited to an agreed number and sizes of bolts or pins and the types of lugs fixed. This may not be easy to achieve. The bulkhead itself could be held in position by fittings attached to these joints.

So far the points raised have been solely those connected with the engine, but the removal of the bulkhead as being part of our engine unit raises other questions. There is primarily the question of accessibility. Where the structure behind the engine nacelle is tubular, access for the purpose of bolting up the mounting and for general assembly of the nacelle to the airframe, or for service repairs can be obtained by having removable panels. Where monocoque construction is used this would not be possible, and access would be difficult.

Against the fireproof bulkhead is a convenient member to which the covering of the rear half of the engine nacelle can be attached, and in some cases the undercarriage fairing. Some other means would have to be provided if the bulkhead were removable. Briefly, the argument in favour of removing the bulkhead is that there are many units and supplies which are not standard but vary with different engines. Against it there is the possibility that assembly might be made more difficult, and present-day design practice would have to be modified to suit the new requirements.

It is unfortunate that the major engine auxiliaries (fuel and oil pipes, and controls) are not more standardised, since but for this the bulkheads could be similar in layout. It would then be unnecessary for it to be removed. Positions for the engine-mounting attachment could be fixed and the bolting-up would be done in front of the bulkhead.

There is a growing tendency for engines to be placed nearer the bulkhead; so close, in fact, as to leave but little space for the installation of control shafts and levers. This practice is not regarded with favour by those whose job it is to arrange the installation, as it strictly limits the run of pipe lines and the positioning of the various units. However, I think it is safe to say that it is easier to work on the front face of the bulkhead than on the rear. Therefore our engine nacelle should consist of the engine in its mounting, complete with all its controls, pipes and electrical leads, exhausts and air intake. All these, where requiring to be connected up to lines or leads in the airframe, would have their unions or plugs mounted on the bulkhead, and the joints already made behind it.

If this scheme were adopted in preference to that of removing the bulkhead as already discussed, the layout of the bulkhead would be somewhat difficult in view of the variation in auxiliaries already mentioned. It would, however, not affect present-day design as applied to the airframe and contribute towards easy assembly in contrast to the previous scheme.

Cooling Problems

The question of cooling arrangements must not be overlooked and would require careful consideration before either scheme is adopted. Liquid-cooled engines, particularly where a large radiator is required, would prove more difficult than air-cooled, as in the case of the former the radiator duct would provide additional snags and would affect the size of the bulkhead. The cowling would also require very careful consideration.

From a brief inspection of the problems connected with interchangeability, and considering the points raised, it does seem that a great deal could be done toward achieving this ideal by the engine manufacturers themselves. All engines of similar horse-power have approximately the same fuel and oil consumption, and there is no reason why petrol and oil pipes should not be standardised. At least, this could apply to the connection to the pump, which has to pass through the fireproof bulkhead from the source of supply.

Secondly, there would appear to be no serious objection to standardising the length and angular movement of engine control levers, such as throttle, mixture and boost. This would be worth while doing, even at the expense of a little weight, if it meant incorporating a lay-shaft and interconnecting links to the engine unit concerned on the rear end of the engine. It would then be possible to use a standard control box, and the controls in the cockpit need not be affected if a change of engine were made. Similarly, it should be possible with little effort to arrange for electrical leads and capillary tubes to be grouped in certain positions agreed upon for engines in a particular class. This, again, might mean longer leads than necessary, but it would, I think, be worth while. A few improvements such as those suggested would go a long way toward simplifying aero engine installations, and would materially assist in the ultimate development of complete interchangeability.

NEW YORK'S NEW AIRPORT AT NORTH BEACH, L.I.: In the foreground is the seaplane base, with a Clipper at moorings. In the background can be seen the six huge hangars, of semi-circular formation.

COMMERCIAL AVIATION

Imperial's Million-dollar Order : Twenty Years of Air Mail : Christening of G-boats

LAST Friday the British air mail service celebrated its twentieth birthday. On November 10, 1919, an Airco De Havilland biplane left Hounslow for Le Bourget carrying mails for certain European countries. The charge was somewhat high, half a crown for an ounce letter plus the ordinary foreign postage and registration fee. Letters for places beyond Paris were carried by rail. The flight of the Airco was the first official air mail flight, but not the first commercial flight to foreign countries, for on August 25, 1919, three converted military aeroplanes left London for Paris, carrying two passengers each. The air fare at that time was fifteen guineas, but it must be remembered that this was before the introduction of subsidies, in the days when it was hoped that civil aviation might, to use Mr. Churchill's phrase, "fly by itself." That hope proved vain, mainly because foreign governments began to subsidise their commercial aviation services and we had to follow suit or go out of business.

It is of interest to point out that on the twentieth anniversary of that day, on August 25, 1939, traffic at Croydon reached its high-water mark. No fewer than 1,500 passengers flew to Croydon from Paris and Le Touquet on that day.

Before the outbreak of war the practice of sending letters by air had become widespread. On the Empire air routes alone Imperial Airways carried 2,116,000 lb. of mails during the first six months of 1939. The "all-up" air mail has now been suspended, but surcharged air mail is still carried to many parts of the world. Twice-weekly services for surcharged mails and for passengers are now operating from this country to Africa, Palestine, India, Burma, Hong Kong, Malaya and Australia. There are weekly air services to Malta and to the Scandinavian countries, and a daily service to Paris.

Imperial Airways announced a few days ago that an order was placed last June for American aero engines amounting to something like one million dollars. This, we believe, is the first official announcement of the transaction, although *Flight* stated many months ago that a number of American engines would be purchased.

The placing of this large order in the United States was a part of the programme drawn up by Sir John Reith when he became chairman of Imperials. The American engines were considered more suitable for conditions on the Empire routes than any immediately available in England. The question of deliveries was also taken into consideration. The engines were wanted in a hurry, and, but for the fact that Great Britain went to war in September, the engines would have been delivered long ago. As it is, the first instalment of the 56 engines ordered

has now left America, being probably the first consignment to leave that country after the Neutrality Act was repealed. It is now expected that deliveries will be completed by next February, as production has continued in the expectation that the Neutrality Act would be changed.

After passing makers' tests and tests for the Air Ministry, the new Short G-class boats are now undergoing acceptance tests by Imperial Airways. Although the first machine to be launched was the *Golden Hind* (in June last), these acceptance tests are being made with the *Golden Fleece*, the former machine having minor modifications made to it.

Our readers will recall that three of these 31½-ton boats were built for Imperial's transatlantic service, and that the experimental flights were made this summer by *Cabot* and *Caribou*. The third of the G-class boats is named the *Golden Horn*. It had been planned to start the passenger service to Montreal and New York via Foynes and Botwood next spring, but developments will now depend upon the course of the war.

"A. VIATOR" TRIES FLYING BLIND

IT is quite interesting to fly across to one of the neutral countries in a machine with no visibility in the cabin. For the average passenger it is perhaps a relief to have no view from the windows, but for the old pilot or very experienced air traveller the sensation is not so pleasant.

It was interesting, too, last week, when the invasion scare was on, to go to a neutral country and find how much greater the tension was there than in belligerent England. Best and most interesting of all, perhaps, was to return here and feel the somewhat squidgy contact of the wheels with British soil. You notice that quite a lot of young women with children and unaccompanied children are travelling on the planes, and that travellers very soon accustom themselves to wartime conditions in civil flying.

Passenger traffic is indeed brisk, and K.L.M. has been fortunate enough to obtain permission to operate a second service in either direction each day.

A little unwise of friend Goebbels to refer to Mr. Winston Churchill contemptuously as a bricklayer, when his own boss is a mere house painter still receiving notes from dissatisfied clients about indifferent workmanship on front doors and such. Better be an amateur bricklayer, I suppose, than a professional brickdropper.

Poor Winston! If he's seen wearing a yachting cap at Brighton he is promptly suspected of setting off personally in a row-boat to sink neutral shipping with a huge and glowing cigar which is in reality a torpedo.

And now I note that they are using pigs to act as syrens in no-man's-land. The idea is, I suppose, that these creatures squeal a high-pitched welcome when they hear brer Nazi cautiously approaching. Very dangerous for the pigs, but not much more so perhaps than hysterical vociferation in a beer cellar.

The brevity of these notes is to be accounted for by my having been out of the country, being well and truly entertained whilst there, having caught cold landing on a damp aerodrome when returning, and having been pretty busy ever since. Many readers will not only forgive me, but hail this brevity, I feel sure, as a welcome innovation.

A. VIATOR.

Not Affected by New Act

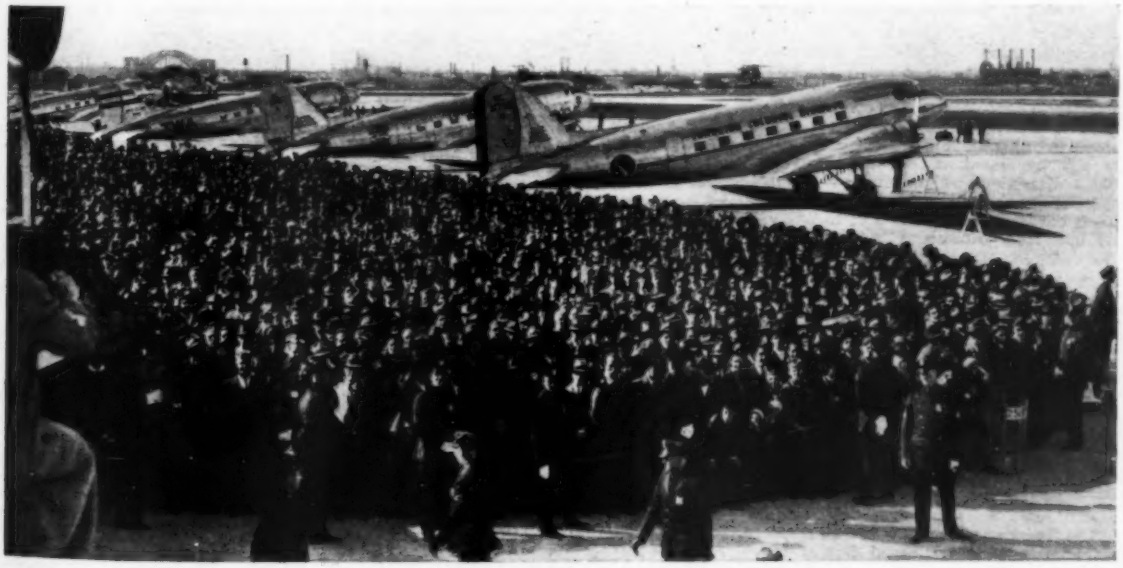
PAN AMERICAN AIRWAYS announce that the recent change in the United States Neutrality Act will not affect their regular transatlantic services which, at present, operate twice weekly in each direction between New York and Lisbon.

Eastern Air Lines Add to Fleet

TO accommodate increased passenger traffic, Eastern Air Lines, of America, have just ordered three more Douglas D.C.3s. The cost of these machines is in the neighbourhood of 350,000 dollars and is additional to the order for three Douglas sleeper transports at a cost of 122,000 dollars per machine. The sleepers will be put on service on the New York-Brownsville (Texas) run. E.A.L. connect with Pan American at Brownsville for Mexico and Central America.

Paris-New York

TO link Paris with Lisbon, and thus with New York via Pan-American Airways, is the latest French announcement of an extension of commercial aviation in that country. Since the outbreak of war this section of the route has been covered by rail.



CIVIC PRIDE: A corner of the huge crowd which attended the official opening of New York's Municipal Airport at North Beach, Long Island. The cost of constructing the airport is said to have been 40 million dollars.

The Industry

PRECISION WORK

Aircraft Precision Ltd., Specialising in Production of Assembly Jigs

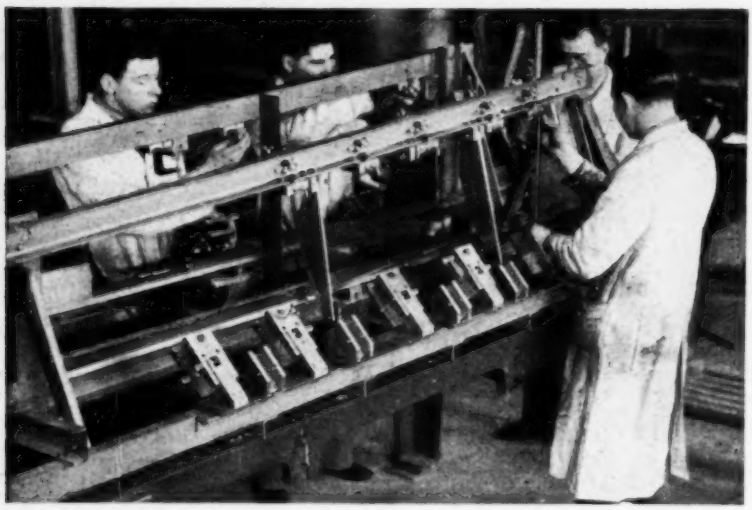
SPECIALISING in the production of press tools and large assembly jigs, Aircraft Precision, Ltd., is well named. They have been in new works for some three months, and production is nicely under way with machine tools all completely new and individually motorised. While, of course, any precision work connected with aircraft is all in a day's work; knowledge of, and experience in, the making of assembly jigs for airframe parts being the particular branch for which this firm caters.

Contracts for jigs and tools are in hand for nearly all the well-known aircraft and engine firms. In fact, demand is such that yet another factory, not very far distant, is now in process of being equipped for production with a further £60,000 worth of new machine tool plant, also all motorised. This, it is hoped, will give sufficient breathing space to take on further contracts. A drawing office is available for original design or other work in connection with contracts.

In a walk round the factory one is impressed by the orderly layout and general tidiness of the working space, but when one learns that Mr. F. E. White, the partner immediately responsible for the practical side of the business, spent many years with the Ford Motor Co. one is not surprised.

The address is Aircraft Precision, Ltd., Progress Way, Commerce Way, Croydon, Surrey.

Mr. J. B. Brent and Mr. F. E. White (right) directors of Aircraft Precision. The chairman of the company is Mr. H. D. Simpson of Castle Craig, Peeblesshire.



Erecting an airframe assembly jig. *"Flight" photographs.*

Graviner Extension

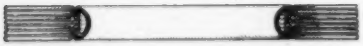
INCREASED orders by the Air Ministry have necessitated the occupation of a further factory to cope with the demand and, since the commencement of hostilities, treble the pre-war number of employees have been engaged to keep the Graviner Manufacturing Company's factory at full pressure.

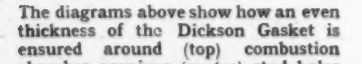
It will be remembered that the Graviner fire-extinguishing apparatus is a system installed in aircraft whereby chemical extinguishers at focal points are automatically operated by crash or other emergency switches independent of manual operation. The original invention was by Captain H. M. Salmond, C.I.E., R.I.N., a retired naval officer.

News of good things travels quickly. The French Embassy have asked for details, and enquiries have also been received from official quarters in the United States of America, Sweden and Japan.

All-metal Laminated Gaskets

CONSTRUCTED entirely of metallic laminations, the Dickson All-Metal Laminated Gasket is claimed to have very considerable advantages over the standard copper-asbestos type. Requiring less pressure to make a perfect seal, either hot or cold, it is obvious that there is less likelihood of cylinder head or block distortion, while, being all metal, there is not the usual disintegration from heat, oil and water. Particulars are to be had from Howard Clayton-Wright, Ltd., Tiddington Road, Stratford.





The diagrams above show how an even thickness of the Dickson Gasket is ensured around (top) combustion chamber openings (centre) stud holes and (bottom) waterways.

AERONAUTICAL PATENT SPECIFICATIONS

(*Published November 9, 1939.*)

1938.

4224. DIXON, H. A.: Wheels for tractors and similar vehicles (513,519).

4463 RENAULT, L.: Manufacture of cylinders and cooling-jackets of internal-combustion engine (513,407).

6943. WHITEHEAD, H.: Adjustable couplings or mounting devices for cameras and the like (513,314).

7251. STANDARD TELEPHONES AND CABLES, LTD., MEERS, R.A., and FILBY, F. G.: Thermionic valve amplifying systems (513,416).

9722. GENERAL ELECTRIC CO., LTD., and BEGGS, S.S. Lighting fittings (513,317).

9869. TELEFUNKEN GES. FUR DRAHTLOSE TELEGRAPHIE: Electric oscillation generators (513,476).

10042. ASSOCIATED EQUIPMENT CO., LTD., and CLEAVER, C. F.: Fluid-pressure or vacuum-operated control devices (513,477).

10045. SOC. ANON DES HAUTS-FOURNEAUX DE LA CHIERS: Apparatus for the determination of the resistance to fracture of test-pieces and the like (513,319).

10051. BRITISH THOMSON-HOUSTON CO., LTD.: Electric remote-indicating systems (513,320.)

10119. HEATON, F.: Electromagnetic contactor switches (513,324).

10312. RIST, D. C. V., and DOO, A. C.: Registration number-plates for vehicles (513,330).

10352. HANCOCK, L. J., and PAYNE, G. I.: Air compressors (513,420).

10367. BENDIX, LTD., and ROBERTS, G. P.: Shoes for brakes (513,331).

10372. COCKBURNS, LTD., and GRANT, T.: Change-over valve device (513,422).

10602. TONKS & SONS, LTD., E., and TONKS, C. A.: Door-bolts of the panic or espagnolette type (513,434).

10609. CLAPHAM, G.: Map-holder or map case and instrument for assisting navigation (513,488).

10634. BRITISH ALUMINIUM CO., LTD., and PULLEN, A. N. D.: Surface treatment of aluminium and aluminium alloys (513,530).

10657. MARCONI'S WIRELESS TELEGRAPH CO., LTD., and OLIVER, E. C.: Electrical remote-control systems (513,336).

10679. SHEVLIN, J. T. (SIEMENS APPARATE UND MASCHINEN GES.): Gun or like turret in particular for aircraft (513,338).

10733. BULLOCH, D. C.: Fastening means of the nut-and-bolt type (513,368).

10745. BOSCH GES., R.: Automatic control of the speed of aero engines by adjustment of propeller (513,339).

10765. BRYAN, S. P.: Latches (513,370).

10773. PRESSED STEEL CO., LTD., and MAYOR, W. C.: Vehicle bodies (513,441).

10832. KODAK, LTD.: Photographic or kinematographic cameras (513,343).

10833. FLEISHER, W. L.: Air-conditioning apparatus (513,444).

10857. STANDARD TELEPHONES & CABLES, LTD., and TERRY, V. J.: Electric signalling systems (513,533).

10883. COLEMAN, C. J., and PITT, G.: Screws and the method of manufacturing them (513,533).

10903. ODDIE, F. A.: Nuts (513,344).

10904. REVROLLE & CO., LTD., A., and CLOTHIER, G. D.: Electric contact devices (513,443).

10969. BATES & SONS, LTD., J. W., and BAILEY, N. J.: Chair frames (513,447).

11012. MATTHEWS, P. W.: Model aeroplanes and gliders (513,534).

11022. GIANETTI, G.: Removable rims for vehicle wheels (513,535).

11029. WHITE, E. L. C.: Electrical oscillation generators (513,536).